1984 Amendments to the Program of Studies for Senior High Schools

i) Replace Table of Contents pages iii to vii.

ii) Typewriting: Replace page 61.

iii) Computer Literacy: This is a new program. Insert Computer Literacy/1 to Computer Literacy/16 following the Business Education section.

iv) Drama: Replace page 62.

v) Health and Personal Development 10: Replace pages 75-76.

vi) Industrial Education: Replace pages 11-12; replace pages 17-18; replace pages 83-84 and insert page 84(i).

vii) Language Arts: Replace pages 152(xiv)-152(xv).

viii) Second Languages:
French — Replace pages 163-164.
Spanish — Replace pages Spanish/3 to Spanish/6.
German — Replace all this section with pages German/1 to German/6.
Latin — Replace pages 164 (xi)-(xii) with Latin/1.

x) Mathematics: Replace all this section with Mathematics/1 to Mathematics/44.

) Science: Replace all this section with Science/1 to Science/35.

i) Social Studies: Replace pages 237-238.

CURRICULUM
LB
1629.5
A3
A35
1978
gr.10-12
amend.
1984
CURRGDHT

ALTA
373.19
1984
Gr.10-12
CURR

373
198
Gr
C

TABLE OF CONTENTS

Page

Developing Desirable Personal Characteristics viii
Religious Instruction ix

Goals of Basic Education 1

1. Art 3
    - Art 10 4
    - Art 20 5
    - Art 21 6
    - Art 30 7
    - Art 31 9

2. Business Education Program 12
    - Accounting 10 15
    - Accounting 20 16
    - Accounting 30 17
    - Business Foundations 10 and 30 19
    - Business Machines 30 21
    - Data Processing Program 22
        - Data Processing 20 23
        - Computing Science 30 25
    - Law 20 28
    - Law 30 33
    - Marketing Program 36
        - Marketing 20 37
        - Marketing 30 38
    - Procedures Program 43
        - Business Procedures 20 43
        - Office Procedures 30 46
    - Record Keeping 10 49
    - Shorthand 50
        - Shorthand 20 51
        - Shorthand 30 52
        - Shorthand 31 53
    - Typewriting Program 56
        - Typewriting 10 57
        - Typewriting 20 58
        - Typewriting 30 60

3. Computer Literacy 10 1-16

4. Drama 62
    - Initial Level (Grades 7 and 8) 63
    - Intermediate Level (Grade 9 and Drama 10) 64
    - Extension of Program for Drama 10 66
    - Advanced Level (Drama 20 and 30) 66
    - Extension of Program for Drama 20 68
    - Extension of Program for Drama 30 68

5. Driver and Traffic Safety Education 10 69

6. Health and Personal Development 10 75

7. Home Economics 1
  Clothing and Textiles 2
    Clothing and Textiles 10 3
    Clothing and Textiles 20 4
    Clothing and Textiles 30 5
  Food Studies 5
    Food Studies 10 6
    Food Studies 20 7
    Food Studies 30 8
  Personal Living Skills 9

8. Industrial Education 1
  Rationale 1
  Industrial Education 10, 20, 30 Programs 1
    A. Electricity/Electronics 5
    B. Materials 7
    C. Power Technology 10
    D. Visual Communications 14
    E. General Modules 17
  Other Industrial Education Courses .... 17(i)
  Industrial Education 12, 22, 32 Programs 18
    Automotives 18
      Mechanics 12 18
      Automotives 22A 19
      Automotives 22B 20
      Automotives 22C 20
      Automotives 32A 21
      Automotives 32B 21
      Automotives 32C 22
    Auto Body 22
      Auto Body 12 22
      Auto Body 22A 23
      Auto Body 22B 24
      Auto Body 22C 24
      Auto Body 32A 25
      Auto Body 32B 26
      Auto Body 32C 26
    Related Mechanics 27
      Related Mechanics 12 27
      Related Mechanics 22A 28
      Related Mechanics 22B 28
      Related Mechanics 22C 29
      Related Mechanics 32A 30
      Related Mechanics 32B 30
      Related Mechanics 32C 31
    Building Construction 31
      Building Construction 12 31
      Building Construction 22A 32
      Building Construction 22B 33
      Building Construction 22C 33
      Building Construction 32A 34
      Building Construction 32B 35
      Building Construction 32C 36
    Machine Shop 36
      Machine Shop 12 36
      Machine Shop 22A 37

- Machine Shop 22B 38
- Machine Shop 22C 39
- Machine Shop 32A 39
- Machine Shop 32B 40
- Machine Shop 32C 41

Sheet Metal 41

- Sheet Metal 12 41
- Sheet Metal 22A 42
- Sheet Metal 22B 43
- Sheet Metal 22C 43
- Sheet Metal 32A 44
- Sheet Metal 32B 44
- Sheet Metal 32C 45

Piping 45

- Piping 12 45
- Piping 22A 46
- Piping 22B 46
- Piping 22C 47
- Piping 32A 47
- Piping 32B 48
- Piping 32C 48

Welding 49

- Welding 12 49
- Welding 22A 50
- Welding 22B 50
- Welding 22C 51
- Welding 32A 52
- Welding 32B 52
- Welding 32C 53

Electronics 53

- Electricity/Electronics 12 53
- Electronics 22A 54
- Electronics 22B 55
- Electronics 22C 55
- Electronics 32A 56
- Electronics 32B 57
- Electronics 32C 57
- Electricity/Electronics 12 (Common Module) 58
- Electricity 22A 59
- Electricity 22B 59
- Electricity 22C 60
- Electricity 32A 60
- Electricity 32B 61
- Electricity 32C 62

Visual Communications 63

- Visual Communications 12 63
- Visual Communications 22A 63
- Visual Communications 22B 63
- Visual Communications 22C 64
- Visual Communications 32A 65
- Visual Communications 32B 65
- Visual Communications 32C 66

Drafting 67

- Drafting 12 67
- Drafting 22A 68
- Drafting 22B 69

- Drafting 22C ... 69
- Drafting 32A ... 70
- Drafting 32B ... 70
- Drafting 32C ... 71

Graphic Arts ... 71
- Visual Communications 12 ... 71
- Graphic Arts 22A ... 72
- Graphic Arts 22B ... 73
- Graphic Arts 22C ... 74
- Graphic Arts 32A ... 74
- Graphic Arts 32B ... 75
- Graphic Arts 32C ... 75

Beauty Culture ... 76
- Beauty Culture 12 ... 76
- Beauty Culture 22A ... 77
- Beauty Culture 22B ... 77
- Beauty Culture 22C ... 78
- Beauty Culture 32A ... 78
- Beauty Culture 32B ... 79
- Beauty Culture 32C ... 79
- Beauty Culture 32D ... 80

Food Preparation ... 81
- Food Preparation 12 ... 81
- Food Preparation 22A ... 82
- Food Preparation 22B ... 83
- Food Preparation 22C ... 83
- Food Preparation 32A ... 84
- Food Preparation 32B ... 84 (i)
- Food Preparation 32C ... 84 (i)
- Food Preparation 32D ... 85

Health Services ... 85
- Health Services 12 ... 85
- Health Services 22 ... 86
- Health Services 32A ... 87
- Health Services 32B ... 88

Horticulture ... 88
- Horticulture 12 ... 88
- Horticulture 22A ... 89
- Horticulture 22B ... 90
- Horticulture 22C ... 90
- Horticulture 32A ... 91
- Horticulture 32B ... 92
- Horticulture 32C ... 93

9. Language Arts ... 147
   - The Philosophy of the Language Arts Program ... 147
   - Goals of Language Arts ... 149
   - General Language Arts Objectives ... 149
   - Statement of Content, English 13-23-33 and 10-20-30 ... 151
   - Electives ... 152(xv)
     - Reading 10 ... 152(xv)
     - Communications 21A and 21B ... 152(xv)
     - Literature 21A and 21B ... 153

10. French as a Second Language ... 154
    - Three, Six and Nine Year Programs ... 154

The 1974 Program 163
Ukrainian as a Second Language 1-9
Spanish as a Second Language 1-6
German as a Second Language 1-6
Latin as a Second Language 1

11. Mathematics 1
Mathematics 10-20-30 3
Mathematics 31 15
Mathematics 13-23-33 19
Mathematics 15-25 27

12. Music 173

13. Occupations 10 177

14. Physical Education 179
Physical Education 10 180
Physical Education 20 187
Physical Education 30 188

15. Production Science 30 189

16. Science 1
Biology 10-20-30 5
Chemistry 10-20-30 21
Physics 10-20-30, 22-32 29
Science 11 35

17. Social Sciences Options 215
Anthropology 215
Economics 216
Geography 218
History 220
Philosophy 222
Political Science 224
Psychology 226
Religious Studies 229
Sociology 230

18. Social Studies 232
Social Studies Defined 232
Objectives of the 1981 Alberta Social Studies Curriculum 232
Minimum Expectations 236
Learning Resources 237
What is Prescribed in Alberta Social Studies 238

DEVELOPING DESIRABLE PERSONAL CHARACTERISTICS

Children inhabit schools for a significant portion of their lives. Each day, in their relationships with fellow students, teachers and other adults who are in the school, children are exposed to a complex combination of influences, some deliberate and others incidental. In Canada, the common pattern of attitudes derives from many cultural sources, religious, ethnic and legal. Public schools exist within this culture and it is from this culture that the schools' dominant values emerge.

The school, as the site of a child's formal education, is not the sole or even dominant determiner of student attitudes. Other important sources of influence include the home, the church, the media, and the community. Educators alone cannot, and must not, assume the responsibility for the moral, ethical and spiritual development of their students. They do, however, play a significant role in support of other institutions. The actions of teachers and the activities which take place in schools contribute in a major way to the formation of attitudes.

Parents and other groups in society clearly expect teachers to encourage the growth of certain positive attitudes in students. These attitudes are thought of as being the prerequisites to the development of essential personal characteristics. For the guidance of all, the following list has been prepared. The list is not a definitive one, nor are the items ranked, but rather the list is a compilation of the more important attributes which schools ought to foster.

The Alberta community lives with a conviction that man is unique and is uniquely related to his world. Generally, but not universally, this expresses itself spiritually, through the belief in a Supreme Being (e.g., God). Moral/ethical characteristics, intellectual characteristics, and social/personal characteristics must be treated in a way that recognizes this reality and respects the positive contribution of this belief to our community.

1. **Ethical/Moral Characteristics**

Respectful — has respect for the opinions and rights of others, and for property.

Responsible — accepts responsibility for own actions. Discharges duties in a satisfactory manner.

Fair/just — behaves in an open, consistent and equitable manner.

Tolerant — is sensitive to other points of view, but able to reject extreme or unethical positions, free from undue bias and prejudice.

Honest — is truthful, sincere, possessing integrity, free from fraud or deception.

Kind — is generous, compassionate, understanding, considerate.

Forgiving — is conciliatory, excusing; ceases to feel resentment toward someone.

Committed to democratic ideals — displays behavior consistent with the principles inherent in the social, legal and political institutions of this country.

Loyal — is dependable, faithful, devoted to one's friends, family and country.

2. **Intellectual Characteristics**

Open-minded — delays judgments until evidence is considered and listens to other points of view.

Thinks critically — analyzes the pros and cons; explores for and considers alternatives before reaching a decision.

Generalization Five — *Typescript should be produced with acceptable job-entry standards of speed and accuracy.*

The student should be able to:

12. Type from straight copy material, syllabic intensity of approximately 1.50, for periods of five minutes duration with not more than one error per minute, and a range from 45 gross words a minute with no errors to 50 gross words per minute with five errors, for minimum standing.

    Occasionally type from straight copy material for periods of ten minutes duration.

13. Type production jobs meeting the speed and accuracy standards expected in business offices and suggested in the teacher's manual that accompanies the text materials used.

14. Type from printed and handwritten copy, edited and unedited, with and without proofreader's marks, and from dictation, live and recorded.

Allocation of Evaluation Factors for Grading

	Performance		**Typewriting**		
Generalizations	**Objectives**	**Jr. High**	**10**	**20**	**30**
One — Techniques	1, 2, 3, 4	40%	25%	10%	80%
Two — Procedures	5, 6	30%	15%	10%	
Three — Production	7, 8		25%	50%	
Four — Work Habits	9, 10, 11		10%	10%	
Five — Speed & Accuracy	12, 13, 14	30%	25%	20%	20%

COMPUTER LITERACY 10

(3 credits)

Computer Literacy 10 is a basic introductory course developed in response to the need to acquaint high school students with a general understanding of computers and their use. The course has been designed in conjunction with computer literacy programs introduced at both the elementary and junior high levels. Additionally, the course has taken into consideration other courses in computer studies, primarily Computer Processing 10-20-30, offered at the high school level. An effort has been made to coordinate and minimize content overlap with other programs and to accommodate students with or without previous computer experience.

NOTE: Teachers are advised to consult the *1984 Computer Literacy 10* curriculum guide for direction concerning the amount of instructional time to be devoted to specific topic areas, and the selection of electives for students without previous computer experience.

Major Goals

The program is designed to achieve the following goals:

1. To develop student understanding of basic computer operations and terminology.
2. To develop an appreciation of the technological development of computer systems.
3. To develop skills, attitudes and interests which facilitate the use of computer systems.
4. To have students appreciate that effective problem-solving with computer systems requires the application of logical thought processes and develop the skills required for a holistic, systematic approach to problem-solving.
5. To have students appraise the applications, limitations and capabilities of computer systems.
6. To promote a greater understanding and increase utilization of computer technology in other subject areas.
7. To have students assess the current and potential impact of computer systems on society.
8. To develop skills, attitudes and interests that will facilitate adaptation to changes in the workplace due to computer technological developments.

Students should be given the opportunity to explore as widely as possible, and be encouraged to pursue investigative activities based upon personal goals and interests.

Software*

One of the following software packages will be necessary to complete portions of the course:

1. Data management program
2. Word processing program
3. Spreadsheet program
4. Simulation packages
5. Graphics processor
6. Music processor
7. Integrative software

---

*Commercial software to supplement the course is under review by Alberta Education.

Learning Resources

Topics 1, 2 and 3:

McRitchie, Margaret. *Programming in BASIC: A Complete Course.* Toronto: Holt, Rinehart and Winston of Canada Ltd., 1982, Chapters 1 to 6.

and ONE of the following texts for Topics 4, 5 and 6:

Kelley, Rob. *The World of Computers and Information Processing.* Toronto: John Wiley and Sons Canada Limited, 1982, 404 pp.

Sanders, Donald H. *Computers Today.* New York, New York: McGraw-Hill Ryerson Limited.

Shelley, Gary B., and Cashman, Thomas J. *Introduction to Computers and Data Processing.* Brea, California: Anaheim Publishing Company, 1980.

CORE COMPONENTS (90%)

Topic 1: Computer Systems

Goals:
1. To develop student understanding of basic computer operations and terminology.
2. To develop an appreciation of the technological development of computer systems.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will: 1.0 DESCRIBE THE BASIC OPERATIONS AND HISTORY OF COMPUTER SYSTEMS.		
1.1 Recognize and use computer terms.	A	Review terminology from the elementary unit and the junior high course, or introduce as required. Additional terms: computer networking, data base, interactive data processing, word processing, information retrieval, artificial intelligence, robot, android, cyberg, cybernetics videotex, teletex, interface, laser, holography, synthesizer, speech recognition device, bubble memory, cashless society, encryption, Electronic Funds Transfer, firmware, megabyte, videodisc, simulation, computer revolution, expert system, and new BASIC commands from Topic 3.

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 1: Computer Systems (cont'd)

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
1.2 Describe the role played in a computer system by people, software, hardware, data, documentation and communications.	A	Each of these components is an essential element in the successful operation of the computer systems being utilized in many areas of society.
1.3 Briefly describe the historical development of computer devices.	AR	Technological changes have influenced the design and capabilities of computers and will affect future computer developments. Comment: Stress should be placed on the trends rather than the details of technological developments.

Topic 2: Computer Operations

Goal: To develop skills, attitudes and interests which facilitate the use of computer systems.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will:		
2.0 PROCESS INFORMATION BY UTILIZING A COMPUTER SYSTEM.		
2.1 Demonstrate responsible behavior in utilizing a computer system.	FR*	Concepts/skills from the junior high course should be reviewed.
2.2 Utilize system commands (DOS) with prepared programs and available hardware.	FR*	Concepts/skills from the junior high course should be reviewed. A variety of software is available to assist in the execution of a given task.

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 3: Computer Programming

Goal: To have students appreciate that effective problem-solving with computer systems requires the application of logical thought processes and develop the skills required for a holistic, systematic approach to problem-solving.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will: 3.0 FOLLOW AN ORDERLY SEQUENCE OF STEPS TO DEVELOP A COMPUTER PROGRAM TO SOLVE A PARTICULAR PROBLEM.		
3.1 Explain the existence of several variations of the BASIC language.	A	Differences in microprocessors and Disk Operating Systems limit compatability of computer software.
3.2 Describe distinguishing characteristics of different data types.	A	Some data types include integer data, floating point, and alphanumeric.
3.3 Code a given procedure (algorithm) into a computer program.	FR*	Skills to be reviewed from junior high or introduced as required include: — applying flow charting concepts, logic and good programming techniques — using NEW, SAVE, LIST, DELETE, LOCK, UNLOCK commands or their equivalent in another computer language — using alphanumeric variables and meaningful variable names in a computer program — applying the rules governing order of evaluation of mathematical operators — providing brief documentation for computer programs (e.g., problem statement, flow charts, REM statements) — producing readable output through appropriate formatting — using BASIC statements: LET, PRINT, INPUT, IF/THEN, GOTO, END, STOP or their equivalent in another computer language — using relation symbols (< > =) — using graphics

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 3: Computer Programming (cont'd)

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
3.3 Code a given procedure (algorithm) into a computer program. (cont'd)	F*	New skills include: — using FOR/NEXT statements, nested loops, READ/DATA, GOSUB, GET, STEP or their equivalent in another computer language — using cursor control keys for editing — controlling a variety of peripheral devices within a computer program
3.4 Be able to analyze computer programs.	FR*	Programs should be tested and debugged and the results checked for correctness. Logic, data and/or syntax errors may occur in programs. Programs should be modified to accomplish a new but related task.
3.5 Display confidence in his/her ability to use and control computers.	F*	Each student should independently design and successfully demonstrate a computer program.

Topic 4: Computer Applications

Goals: 1. To have students appraise the applications, limitations and capabilities of computer systems.
2. To promote a greater understanding and increase utilization of computer technology in other subject areas.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will:		
4.0 UNDERSTAND THE APPLICATIONS, LIMITATIONS, AND CAPABILITIES OF COMPUTERS.		
4.1 Identify specific tasks performed by computers in various areas of society.	AR	There are many tasks appropriate for computer application in various areas of society. Some problems require computer use while others do not. Computers are controlled by programs and can only do what people instruct them to do. Innovations in hardware and software continually expand the uses of computers.

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
4.2 Describe ways in which information may be retrieved from data bases.	A	The retrieval and sending of data may involve radio, television, telephone, satellite, cable networks. Teletex, videotex systems and information retrieval bases are in use in Europe, North America and Japan.
4.3 Describe factors that limit computer use.	U	Cost, software, storage capacity, hardware speed and compatability, legal constraints, and people's attitudes may limit the use of computers.
4.4 Describe how computers are used to control other machines and devices.	U	Rapid developments are occurring in the fields of robotics and cybernetics. See also objective 5.5.
4.5 Manipulate information using a commercially prepared interactive data processing program.	F*	Students should use an interactive data processing package such as: Data base programs may be used for a variety of applications including inventory control, personnel records, accounting and customer files. Students using data base programs should start a new file and add, edit, delete, search for, and print records. AND/OR Word processors may be used by students for compositions in various subject areas. AND/OR Students can use an electronic spreadsheet in a selected project: personal budget, income taxes, running a small business (school canteen or store), projecting various rates of inflation, calculating mortgage payments at various rates of interest. AND/OR Students may use a simulation in various subject areas (e.g., music and graphic processors and/or investigate capabilities of integrative software).

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 5: The Societal Impact of Computers

Goal: To have students assess the current and potential impact of computer systems on society.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will: 5.0 APPRECIATE THE IMPACT THAT COMPUTERS CAN HAVE ON OUR LIFESTYLE.		
5.1 Identify factors that contribute to our increasing dependence on computer based systems.	U	Factors such as the following should be identified: Costs of hardware are decreasing while capabilities are increasing (cost-benefit ratio). Business institutions must utilize technology to keep pace with the competition. We are currently witnessing the shift from an industrial/energy based society to an information society (computer revolution). The need for efficiency in utilization of scarce resources may force us to adapt to an information based society. Computers can eliminate boring, repetitive jobs. The amount of information made available through the use of electronic technology prevents any individual from maintaining complete knowledge of his/her subject field.
5.2 Assess the impact that computers have in the distribution and use of economic, social and political power.	U	Computer impacts such as the following should be identified: Access to current information is a powerful asset for economic and political institutions. Technological developments could permit instant polling and direct consumer and citizen input into decision-making. An increasing proportion of our economy is dependent upon information technology. What are the implications of developing a "cashless society"?

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
5.2 Assess the impact that computers have in the distribution and use of economic, social and political power. (cont'd)	U	Computer technology, coupled with new telecommunication devices and mass data storage facilities could permit surveillance of citizens, major changes in the formal education system, and a shift of the populace from urban to rural environments. The new information technologies could have a major impact on traditional media. Information technology affects the reporting of current events, world governments, international standards and the exploration of space and the ocean. Will access to information technology widen the gap between developed and developing nations? Electronic technology permits new forms of entertainment, communication and lifestyles. Will we become economically and psychologically dependent upon this technology?
5.3 Assess the impact of computers in the workplace.	U	Computer impacts such as the following should be identified: Computers are causing changes in the availability and type of jobs. Shifts in employment patterns will have psychological as well as economic effects. Electronic technology could foster a decentralization of the workplace (cottage industry). Retraining programs may be required for people displaced by technological change. New employment opportunities may be available for disabled people. Both labor unions and management may have different roles in an information based society. Technological innovations could allow shorter and more flexible work hours, fostering an expansion of the recreation industries. Surveillance of productivity and employees is facilitated by electronic technology. There may be health and safety risks involved when using electronic technology in the workplace. How can the benefits of automation be shared throughout all levels of society?

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
5.4 Distinguish between human capabilities and computer capabilities.	U	Capabilities such as the following should be identified: Human beings have intuitive and creative abilities, emotions, complex language and social skills, senses, and the ability to make value judgements. Humans are capable of nonlinear, time independent, nonsequential, random and pattern oriented thought. Computers are best suited for tasks requiring speed, accuracy, repeated operations, and processing of large amounts of data. Computers are primarily capable of linear, time sequential, non-intuitive, structured and incremental learning. Humans and computers are interdependent in an information based society.
5.5 Describe the current and potential uses of artificial intelligence.	U	Issues such as the following should be identified: Computers were developed by human beings and represent an imperfect reflection of human intelligence. As we move computers from a linear, left brain orientation into the right brain realm of inference and intuition, computers could simulate many human intellectual activities. Only the most basic intelligent human behaviors have been incorporated into computer programs and related hardware (e.g., robots and androids). Artificial intelligence is a simulation of "humanness" by electronic computers. It includes a number of areas such as natural language processing, problem-solving and pattern recognition. Cybernetics is the comparative study of the automatic control system formed by the nervous system and brain and the control system of electromechanical communication systems and devices. Cybernetics examines the relationship between humans and machines.

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
5.5 Describe the current and potential uses of artificial intelligence. (cont'd)	U	Intelligent machines/devices could obey our spoken commands and answer our questions, control artificial limbs and organs or act as companions for the lonely or elderly. Microprocessors implanted in our bodies could give us better memory, or relieve pain, deafness, blindness or augment our senses so that we can have telescopic vision, see x-rays or infra-red, or hear radio waves. As computers become able to replace/extend human senses, left brain and motor functions, human beings may gain additional economic/social value from their creative abilities. Will the implanting of microprocessors in the human body alter our concept of "humankind"? What are the moral-ethical implications of implanting microprocessors in human beings?
5.6 Propose an appropriate role for computers in society.	U	Issues such as the following should be identified: There are risks involved in utilizing computer systems: Economic — high unemployment and retraining costs — dependency on computers necessitates high cost contingency plans for emergency situations — economic decisions may be based upon erroneous computer data or programs — some organizations may be unable to keep pace with rapid technological change Personal — increase in stress potential due to rapid technological change — some health problems/diseases may be associated with use of computer systems Defense — increasing dependence upon computerized defense mechanisms could create enormous problems for humankind if there are errors in programs or equipment

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
5.6 Propose an appropriate role for computers in society. (cont'd)	U	Communications — errors in transmission of electronic data or the breakdown of computer systems may have serious economic, political and personal consequences. There are numerous issues related to privacy and security in the use of computerized information systems: — What is privacy and do we have a right to privacy within the Canadian Constitution? — How does the concept of "privacy" relate to the political system of a nation? — What information is contained in large data banks? — What are universal identifiers and how could they be used to access information in data banks? — How reliable is data bank information? — Who owns the information on file? — Who should have access to the information? — Who decides how the information should be stored? — Who decides how the information is used? — What benefits are associated with storage of personal information? Some regulatory procedures help to insure integrity of personal data files located in Canada: — Privacy Act (Bill C-43, 1982) — Access to Information Act (Bill C-43, 1982) — citizen use of Access Register (1983) — Office of the Privacy Commissioner and/or Ombudsman — use of passwords, numbers, protected files, encryption codes and other electronic controls — industry self-regulation — judicial challenges based upon the Canadian Constitution (Canadian Charter of Rights and Freedoms) and other government legislation Are these procedures adequate to preserve our right to privacy? Are laws governing freedom of access to information incompatible with the right to privacy?

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
5.6 Propose an appropriate role for computers in society. (cont'd)	U	What regulatory procedures are used in other countries to insure integrity of personal data files? Can computers be used by knowledgeable criminals to steal money or information? How could this information be used by interested parties? Do computer scientists, operators, etc., face significant moral issues when developing computer programs or hardware, or operating data banks? What regulatory procedures and other means could prevent the misuse of computers in society? Could people's values be in conflict with computer applications? As technology permits an international dissemination of information, regulation of information flow is complicated by differences in national laws regarding privacy, copyright, and espionage. Do extradition treaties and reciprocal agreements apply to cases involving misuse of information?

Topic 6: Computer and Information Processing Careers

Goal: To develop skills, attitudes and interests that will facilitate adaptation to changes in the workplace due to computer technological developments.

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
The student will:		
6.0 INVESTIGATE COMPUTER AND INFORMATION PROCESSING CAREERS.		
6.1 Identify careers directly involved with the computer and information processing industries and project future career choices.	A	Major categories of computer careers include data preparation clerk, coding clerk, computer operator, programmer, systems analyst and consultant, tape librarian, maintenance engineer, data processing manager, data base manager, sales personnel.

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

OBJECTIVES	DIMENSION STATUS	CONCEPTS/SKILLS/COMMENTS
6.2 Describe some careers in which computer skills are desirable.	A	See objectives 4.1 and 5.3. Examples include accountant, researcher, auditor, manager, etc.

ELECTIVE COMPONENTS (10%)

Any one of the elective topics listed, or a portion thereof, may be selected to complete the elective component. Teachers are reminded that *the elective is a mandatory component of the program.*

Topic 1: Computer Systems

OBJECTIVE	DIMENSION
The student will:	
Differentiate between analog and digital computers.	A
Describe how digital computers operate upon information which has been encoded in binary utilizing the base 2 number system.	A
Describe the components of a CPU and explain how it controls what a computer does.	A
Describe the characteristics and demonstrate proper use of secondary storage systems.	A
Distinguish between parallel and serial communications.	A
Contrast the advantages/disadvantages of various input/output devices.	A
Recognize types of user interaction (e.g., batch, interactive, distributive).	A
Describe the function of some communication technologies (e.g., modem, acoustic coupler).	A
Identify that software includes operating systems, compilers and application (user) programs.	A
Identify factors that contributed to the evolution of computer systems (social, economic, geographical, technological).	A

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 2: Computer Operations

OBJECTIVE	DIMENSION
The student will:	
Identify other Disk Operating Systems.	A
Explain the difference between two Disk Operating Systems.	A
Use two or more Disk Operating Systems.	F*

Topic 3: Computer Programming

OBJECTIVE	DIMENSION
The student will:	
Distinguish between high and low level computer languages.	A
Identify some common computer languages.	A
Describe the standard flow chart symbols.	A
Draw a flow chart to represent a solution to a problem.	F
Read and explain a flow chart.	F
Indicate knowledge of AND, OR, NOT logic by using it in a program (Boolean Logic).	F*
Use array variables in a program.	F*
Use DIM statements in a computer program.	F*
Use graphics and/or sound capabilities in a computer program.	F*
Use library functions (e.g., INT, SQR, RND) in a program.	F*
Use other programming statements in BASIC or in another computer language.	F*

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 4: Computer Applications

OBJECTIVE	DIMENSION
The student will:	
Describe where and how computer graphics and sound are used (e.g., art, music, etc.).	A
Describe several computerized sampling techniques and statistical methods used in the social sciences.	A
Describe the magnitude and changing nature of the computer market place.	A
Analyze factors to be considered when purchasing a computer system.	A
Use a computer simulation to demonstrate understanding of the effects/interaction/limitations of variables.	FU*
Describe the time-sharing system of a large complex computer and the process of being on-line (suggested field trip and/or accessing an information retrieval system).	F*
Select, on the basis of program documentation and computer capabilities, a commercial program appropriate to the execution of a given task.	F*

Topic 5: The Societal Impact of Computers

OBJECTIVE	DIMENSION
The student will:	
Analyze case studies on access to information and security of data.	A
Visit computer applications and installations in his or her geographical area. Report and share information collected.	A
Build a data base and manipulate the data to meet identified needs.	FA*

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

Topic 6: Information Processing Careers

OBJECTIVE	DIMENSION
The student will:	
Identify the educational requirements for specific computer careers.	A
Identify courses and programs which aid in preparation for information processing careers.	A
Report and share information on a computer career.	A
Identify typical employers of information processing personnel.	A
Visit computer installations to identify computer-related career opportunities. Report and share information collected.	A

Note: Dimension Codes — A = Awareness; F = Function;
U = Critical Understanding
Status Code — R = Review (covered in Junior High course)
Hands-On Required — *

DRAMA

PRELIMINARY STATEMENT

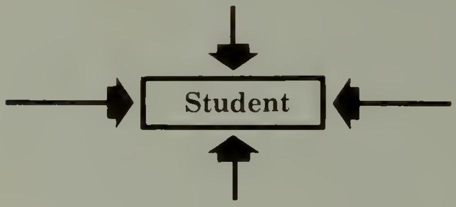
Dramatic activity involves the whole person — the development of the individual through experience and expression of his creative self — in movement, mime, dance, improvisation or the scripted play.

All drama — and we use the term to include not only formal theatre but the study of improvisation, pantomime, film, television, media shows, dance, opera, radio plays, etc. — *can be creative* — if presented in such a way that the full resources of each individual are challenged.

The Secondary School Drama Curriculum from Grades VII to XII is predicated on the belief that drama must begin with development of the creative faculties of the student. From this base the course is built progressively in order to obtain for the student at the advanced level the broadest possible theatrical experience, for example, play production, critical viewing of theatre, film, television, film production, etc. Therefore, teachers should note that this program of studies differs from the previous one in that the program is not developed through five or six grades but through *three levels*.

Level 1

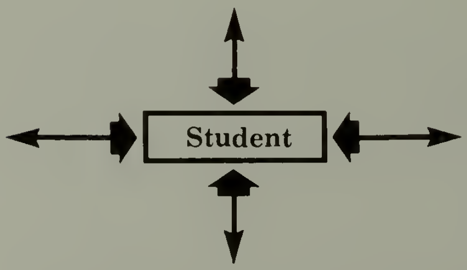
Initial — development of creative faculties.



THE ARROWS INDICATE A FLOW of experiences provided by the teacher to develop personal resources and lay foundations for further creative exploration.

Level 2

Intermediate — enrichment of creativity and a growing awareness of art form which may include the limited theatre experience.



The two-way process of student-teacher shared responsibility for further development and growing awareness of theatre form.

HEALTH AND PERSONAL DEVELOPMENT 10

Course Content

Unit 1 — Success in High School

Orientation
Learning

Unit 2 — Our Physical Growth into Adulthood

The Nature of the Body
Functions of the Body

Unit 3 — Canada's Progress in Public Health

Why Public Health Service?
Improvement of World Health
The General Health Picture in Canada
Canada's National Health Program
Growing Recognition of the Alcohol Problem

Unit 4 — Public Health in Alberta

Importance of Health Statistics
Public Health Measures in Alberta

Unit 5 — Personality

The Meaning of Personality
Character
Personality Under Stress

Unit 6 — Group Life

The Group's Responsibilities to the Individual
The Family Group
The Group and Leisure Time

Unit 7 — Man's Marvellous Control System

The Nervous System and Its Work
Disorder in the Nervous System

Unit 8 — Preventing Accidents and Meeting Emergencies

Protection in Public Transportation
Safety in Recreation
Safety in Industry
Alcohol and Safety

Unit 9 — Selecting a Vocation

The Importance of Career Planning
The Importance of Interests and Aptitudes in Choosing a Vocation
Personality and Its Relationship to Vocational Choice
Job Families and Job Opportunities
Making the Most of Opportunities to Secure Employment
Effective Procedures in Applying for a Job
Making Good on the Job

2. Energy Transfer
3. Energy Utilization

Objectives

The objectives of the modules in power technology are:

1. To make the student aware of a number of ways to convert energy forms and to use various methods of transferring the converted energy to an intended use.
2. To give the student an opportunity to practise troubleshooting techniques utilizing analytical thinking.

Prescribed Learning Resources

Crouse, W.H. *Automotive Mechanics*. McGraw-Hill Ryerson, 1980.

Thiessen, F., Dales and Davis. *Automotive Principles and Service*. Prentice Hall of Canada, 1981.

Content

Generalizations, concepts and sub-concepts are outlined on the following pages. Teachers are expected to develop additional objectives and activities to supplement the identified content and maintain relevancy.

Module One. **Conventional Heat Engines**

1. Safety
2. Identification and Use of Tools and Equipment
   — hand tools
   — power tools
   — measuring instruments
   — care and maintenance
   — special tools
3. Combustion Engines
   — energy forms
   — types of combustion engines
   — basic maintenance
4. Alternate Energy Sources
   — sources
   — applications

Module Two. **Small Engine Repair**

1. Safety Practices
2. Repair
   — diagnostic tests
   — engine overhaul
   — costing

Module Three. **Small Engine Tune-up and Troubleshooting**

1. Safety
2. Tune-up and Troubleshooting
   — systems
   — diagnostic tests
   — servicing and tune-up
   — manuals and specifications
   — ordering parts and costing

Module Four. **Mechanical Systems**

1. Safety
2. Power Transmission
   - definitions
   - transmission devices
   - lubrication
   - seals
   - operation

Module Five. **Non-Conventional Power Sources**

1. Safety
2. Electricity and Electric Motors
   - magnetism
   - electric components
   - measurement
   - motors

Module Six. **Electrical and Electronic Systems**

1. Safety
2. Electrical Devices in Automobiles
   - magnetism and electricity
   - alternators
   - regulators
   - motors
   - measurement

Module Seven. **Electro-Mechanical and Electronic Control**

1. Safety
2. Electronic Circuitry
   - schematics
   - components
   - ignition system
   - appliances

Module Eight. **Appliance Repair and Troubleshooting**

1. Safety
2. Electrical Appliances
   - schematics
   - appliance operation
   - diagnosis
   - testing
   - repair

Module Nine. **Automobile Maintenance**

1. Safety
2. Regular Maintenance
   - exterior — interior
   - lubrication
3. Systems
   - cooling
   - braking
   - steering
4. Tires

- orthographic projection
- isometric projection
- perspective
- dimensioning — lettering

Module Twelve. **Customer Service**

1. Safety
2. Customer Service
   - job analysis
   - personnel organization
   - production
   - monitoring

Module Thirteen. **Offset Printing Production**

1. The Journalism Process
   - preparation of reports and advertising
   - production techniques
   - appropriate layouts for specific jobs
   - offset camera applications
   - offset reproduction
   - binding

E. General Modules

Introduction

The three modules described may be used once by a student to augment any one of the four major fields of study.

1. **Research**

   The purpose of the research module is to allow individual students to engage in an in-depth study of a problem related to any of the career fields.

   The module provides for individualizing the program to allow for special interests of students. The student should prepare a proposal of his/her research and have it approved by the teacher. The proposal should contain:

   (a) A statement of the problem.

   (b) The procedure to be followed in the research of the problem.

   (c) A list of the materials and lab facilities to be used.

   (d) A time line of activities.

   The time period is 25 hours and qualifies as a regular module.

2. **Developmental**

   The purpose of the developmental module is to provide a 25-hour block of time for the teacher to try out new content with his/her class. The content of the proposal or project should be discussed with the Associate Director of Curriculum for the Practical Arts.

3. **Production Science**

   The purpose of the production science module is to provide for a class project in setting up a company to produce a product or service.

   The teacher may select content from the Production Science 30 curriculum guide to develop a 25-hour module.

OTHER INDUSTRIAL EDUCATION COURSES

DRAFTING 10

Drafting is a 3, 4 or 5-credit course which provides for exploratory experiences in drafting along with the development of some basic skills.

Content is to be selected from the outline given for Drafting 12 (see page Industrial Education/67) and should include the following general topics:

1. Reading working drawings and blueprints.
2. Use of drafting equipment.
3. Geometric construction.
4. Working drawings.

DRAFTING 20

Drafting 20 is a 3, 4 or 5-credit course which expands on material presented in Drafting 10. Content should include the following:

1. General review.
2. Geometric construction.
3. Orthographic plate involving circles or arcs of circles.
4. Isometric plate involving circles or arcs of circles.
5. Surface development.
6. Cabinet drawing.
7. One-point perspective drawing.
8. Two-point perspective drawing.
9. Architectural drafting.
10. Aircraft drafting.

INDUSTRIAL EDUCATION 12, 22, 32 PROGRAMS

Introduction

The Industrial Education 12, 22, 32 program is a series of modules which develop competencies leading to seven different career fields.

Entry into a career field may be gained by taking one of several introductory courses. These are:

1. the "12" course designated for each major, or
2. two modules from the Industrial Education 10, 20, 30 series related to the anticipated major, or
3. one half of a 12 course. The other half would be another half 12 or a module from the 10 program. The course would be recorded as Industrial Education 10.

Following the introductory course the student may advance to the major area of study by selecting any number of five-credit modules from the courses designated as "22" or "32". The scheduling and sequencing of the modules is the responsibility of the local school personnel but must be in accordance with the regulations pertaining to prerequisites.

A student registered in a second or third level course (22 or 32) is regarded as taking a major in that course area. Having established a major the student may select courses designated as minors and in this way broaden his/her practical skill base in a career field or even several career fields. However, students must complete all the preceding modules in a major series (usually six) before taking the 32C module (exception: Beauty Culture).

Automotives

Mechanics 12 (5 credits)

Introduction

Mechanics 12 is an introductory course leading to all the major areas in the career field of mechanics. The student is introduced to power sources and methods of transmission. The student studies the construction and operation of machines, particularly the motor vehicle, and engages in the activities of testing, disassembly and assembly of machines, reading, researching and applying information learned to analyzing and repairing minor machine problems.

Objectives

The specific objectives of the Mechanics 12 course are:

1. To enable the student to understand the use, care and control of the power machine.
2. To allow the student to gain an insight into the construction and operation of machines which convert energy to useful work.
3. To provide the student with realistic experiences so that he/she is better able to make a career choice based on accurate information.
4. To help the student understand the many basic laws and principles of science at work in mechanics, and relate these laws and principles to the vast area of power technology.

Prescribed Learning Resource

Thiessen, F. and Dales, Davis. *Automotive Principles and Service,* Prentice Hall, 1981.

Food Preparation 22B (5 credits)

(Cold Kitchen Production)

Introduction

This module gives the students practice in the preparation of food on a commercial scale. Emphasis is placed on desserts, sandwiches, salads, garnishes and appetizers. Artistic skills are practised in displaying cold buffets and in the preparation and merchandising of salads, sandwiches and appropriate desserts.

Objectives

The objectives of Food Preparation 22B are to:

1. Introduce the student to the principles, practices, tools and equipment related to cold kitchen and dessert production.
2. Allow the student the opportunity to practise the methods and organization for cold kitchen and dessert production.

Prescribed Learning Resource

Morgan. *Supervision and Management of Quantity Food Preparation.* McCutchan Publishing, 1974.

Content

1. Cold Kitchen Production
   — sandwiches
   — pantry
2. Salads
3. Appetizers
4. Desserts and Short Pastry Products

Food Preparation 22C (5 credits)

(Short Order)

Introduction

This module on short order cooking gives the student the opportunity to practise the skills and use the knowledge essential to the proficient short order cook.

It is assumed that the student has already developed some skills and this experience can be put to direct use.

Objectives

The objectives of Food Preparation 22C are to:

1. Allow the student to practise short order cooking.
2. Provide information to the student on the practices and principles associated with short order cooking.

Prescribed Learning Resources

Morgan. *Supervision and Management of Quantity Food Preparation.* McCutchan Publishing.

Haines. *Food Preparation for Hotels, Restaurants and Cafeterias.* American Technical Society.

Content

1. Short Order Cooking
2. Dairy Products
3. Fats and Oils
4. Cereals and Breakfast Foods
5. Serving Food

Food Preparation 32A (5 credits)

(Kitchen Production)

Introduction

This module on kitchen production is a continuation of work begun in Food Preparation 22A and is open to any student who has credit for the same. Emphasis is placed on gaining more in-depth knowledge of the structure and cooking of meat and on the preparation of a variety of sauces, soups, salads and vegetable dishes.

Objectives

The objectives of Food Preparation 32A are to:

1. Familiarize the students with the structure and composition of meat.
2. Allow students to practise cutting meat.
3. Provide students with opportunity to practise meat cookery.
4. Provide students with the opportunity to prepare a wide range of soups, sauces and vegetable dishes.

Prescribed Learning Resources

Morgan, *Supervision and Management of Quantity Food Preparation.*

Pauli, *Classical Cooking.*

Content

1. Meat
   - — proper cooking
   - — its fibre structure
   - — its fat and moisture content
   - — connective tissue
   - — consumption
2. Fish
   - — high food value
   - — versatility
3. Poultry
   - — methods of cooking
   - — kinds of meat
   - — dressing

4. Sauces, Soups, Salads and Vegetable Dishes
5. Behavior
   — service to the public

Food Preparation 32B (5 credits)

(Baking and Decorating)

Introduction

This module covers the preparation and decoration of cakes, cookies, pastries, yeast goods and desserts.

Objectives

The objectives of Food Preparation 32B are to:

1. Introduce the student to the principles and practices underlying the quality production of cakes, pastries and yeast goods.
2. Provide the student with practice in baking.
3. Allow the student to develop some basic cake decorating skills.

Prescribed Learning Resource

Haines. *Food Preparation for Hotels, Restaurants and Cafeterias.* American Technical Society.

Content

1. Baking Ingredients
   — the properties that they exhibit under various conditions
2. Cakes, Pastries and Yeast Doughs
3. Decorating and Filling Cakes, Yeast Goods and Pastries
4. Desserts
   — selection
   — suitability
   — preparation

Food Preparation 32C (5, 10 credits)

(Kitchen Management)

Introduction

Food service management, like other management situations, consists of carrying out the functions of an establishment to satisfy the needs of the consumer and earn a profit for the investor. In this module the student will study sanitation, food processing, nutrition, purchasing, storing and control of kitchen inventory.

The module may be taught for 5 or 10 credits, allowing time for the student to gain some experience in industry under the work study plan.

ENGLISH 30

1. Gehle, Q.L. and D.J. Rollo, *The Writing Process,* Canadian Edition, Nelson, 1981.
2. Winkler, A.C. and J.R. McCuen, Dent, *Rhetoric Made Plain,* Canadian Edition, Academic, 1981.
3. Perrine, L., *Story and Structure,* Revised Edition, Academic, 1981.
4. New, W.H. and W.E. Messenger, *Active Stylist,* Prentice-Hall, 1981.
5. Miller, J.E., *The Lyric Potential,* Gage, 1981 (1974).
6. Hogins, J.B., *Literature: Poetry,* Science Research Associates, 1981 (1974).
7. Gillanders, C. *Theme and Image II,* Copp Clark Pitman, 1976.
8. Landry, A.S. *The Heath Introduction to Literature,* D.C. Heath Canada Limited, 1981.

ENGLISH 13-23-33 Handbook

Bell, J.B. and E.P.J. Corbett. *The Little English Handbook for Canadians,* John Wiley and Sons Canada Limited, 1977.

Communications Handbook, Nelson Canada Limited, 1981.

ENGLISH 10-20-30 Handbook

Messenger, W.E. and J. de Bruyn. *The Canadian Writer's Handbook,* Prentice-Hall Canada Inc., 1980.

Shaw, H. *Handbook of English,* Third Canadian Edition, McGraw-Hill Ryerson, 1979.

Note: See *Senior High Language Arts Recommended Novels, Nonfiction and Drama* 1983 for the novels, nonfiction, Shakespearean plays for English 10, 20, 30 and 13, 23, 33. The list of modern plays will be available in mid-1985.

ELECTIVES

Reading 10

(See the Reading 10 Curriculum Guide.)

Communications 21A and 21B

Introduction

Communications 21A and 21B are offered in module form for three credits each. A maximum of six credits is available to a student taking modules in the communications elective.

The communications modules subscribe to the major objectives as stated in the *Secondary Language Arts Handbook*. All modules focus on the basic skills of writing, reading, viewing, listening, speaking and acting as well as providing for student involvement, excitement and enjoyment. In the communication modules, emphasis has been placed on the improvement in writing skills as an ongoing process.

Course Content

Choice can be made from fifteen modules. Credit value is shown after each module:

Business Communications (3 or 6 — Part A prerequisite to Part B)
Community Relations Network (3 or 6)
English as a Second Language (6)
Film (3 or 6 — Part A prerequisite to Part B)
How, What and Why of Writing (3 or 6 — Part A *not* prerequisite to Part B)
Journalism (3 or 6 — Part A prerequisite to Part B)
Language as a Manipulative Device (3 or 6 — Part A prerequisite to Part B)
Language Growth (3 or 6)
Plain Speaking (3)
Purposeful Speaking (3)
Radio (3)
Speeded Comprehension (3)
Television (3 or 6 — Part A prerequisite to Part B)
Thinking — The Core of Communication (3 or 6 — Part A prerequisite to Part B)
Writer's Workshop (3 or 6 — Part A *not* prerequisite to Part B)

Recommended Material

A number of references are suggested for each module, but no textbooks are prescribed. Refer to the *Secondary Language Arts Handbook* for a list of these materials.

2. THE CONTENT SPECIFIED IN THE CATEGORIES OF LANGUAGE USE
3. THE SKILLS AND CONCEPTS IDENTIFIED IN THE PERFORMANCE STATEMENTS
4. THE MAJOR CULTURAL THEMES.

The elective components consist of:

1. THE SUGGESTED VOCABULARY
2. THE SUGGESTED TOPICS FOR EACH MAJOR CULTURAL THEME.

These elective components are found in the appropriate curriculum guide.

I. PRESCRIBED RESOURCES

1. Three-Year Program

1. Vallette, R.M. and Valette, J.P. *French for Mastery.* 2d. ed. Toronto: D.C. Heath and Company, 1981. Books 1 and 2.
2. Valdman, Albert, et al. *Son et Sens/Scènes et Séjours.* 2d. ed. Glenview, Ill.: Scott, Foresman and Company, 1977.
3. *Nos Amis/Le Monde des Jeunes.* French 1 and 2. New York: Harcourt Brace Jovanovich, 1980.

2. Six-Year Program (Senior High)

1. Calvé, R. et al. *Le Français International.* 2d. ed. Montréal: Centre Educatif et Culturel Inc., 1974-1979. Books 3 to 6.
2. McConnell, G. Robert et al. *Vive le Français.* Levels 4, 5 and 6. Don Mills, Ontario: Addison-Wesley, 1980-83.

3. Nine-Year Program (Senior High)

1. Kenny, M. et al. *Passeport Français.* Toronto: D.C. Heath Canada Limited, 1973. Levels 5 to 8.
2. Love, Jane and Majhanovich, Suzanne. *En français s'il vous plaît C: Partez.* Toronto: Copp Clark Pitman, 1982.
3. Majhanovich, Suzanne and Willis, Pauline. *En français s'il vous plaît D: A toute vitesse.* Toronto: Copp Clark Pitman, 1983.

II. THE 1974 PROGRAM

A. SUGGESTED EXPECTATIONS FOR FRENCH AT THE END OF LEVEL ONE

The curriculum outline included on Pages 8-27 of the curriculum guide* identifies the language content to which students will be exposed during LEVEL ONE, and it suggests the linguistic and attitudinal behaviours expected of students at the end of this level of language learning.

LEVEL ONE is considered to be an initial experience in learning the French language, and it may occur at any grade(s) of the student's career in the secondary school. The attainment of LEVEL ONE proficiency may occur in a variety of ways, such as the successful completion of:

---

* *French as a Second Language.* Tentative Curriculum Guide, Levels 1, 2 and 3 (Secondary), 1974.

a) a three-year program in the junior high school;

b) a two-year program in the junior high school, equivalent in time exposure to three years of study;

c) a one-year program in the senior high school, during which students learn the concepts and develop the skills and attitudes suggested for LEVEL ONE.

The successful completion of LEVEL ONE by a student should result in his subsequent placement in a LEVEL TWO program, i.e. French 20. **In schools where the students have been exposed to more than the core content required of LEVEL ONE, it is suggested that students register in French 11 when it is offered.**

B. SUGGESTED EXPECTATIONS FOR FRENCH AT THE END OF LEVEL TWO

The curricular outline included on Pages 29-38 of the curriculum guide* identifies the language content to which students will be exposed during the intermediate level of language learning and suggests the linguistic and attitudinal behaviours expected of these students at the end of that level.

This intermediate level is considered to be LEVEL TWO. The completion of LEVEL TWO should be equated with successful achievement in French 20 and French 30. **In schools where French 11 and 21 are offered, LEVEL TWO is considered to be equivalent to the successful completion of these two courses.**

Note: At the end of LEVEL TWO, students are expected to have mastered the vocabulary of *Le Français Fondamental, Premier Degré,*** along with the language content suggested for LEVEL TWO in the curriculum guide.

C. SUGGESTED EXPECTATIONS FOR FRENCH AT THE END OF LEVEL THREE

The curricular outline included on Pages 40-43 of the curriculum guide* identifies the language content to which students will be exposed during the advanced level of language learning and suggests the linguistic and attitudinal behaviours expected of these students at the end of that level.

The advanced level is considered to be LEVEL THREE, and its implementation as a course should reflect an emphasis on cultural understanding and an appreciation of the way of life of French-speaking peoples, especially those living in Canada, rather than an exclusive focus on the continued development of linguistic skills. **French 31 is the course to be implemented at LEVEL THREE.** Either French 21 or French 30 is prerequisite or corequisite for French 31.

French 31:

French 31 is intended to further the objectives suggested for the learning of a second language, namely cultural understanding and effective communication. French 30 is a prerequisite or a corequisite of French 31, although in schools where French 11 and French 21 are available, it will be offered to students who have successfully completed French 21.

**French as a Second Language.*

**Available from the School Book Branch.

(Revised 1981)

4.4 developing a conscious knowledge of the skills and strategies used in learning a second language.

5. To develop a desire to extend or improve a proficiency in languages through further language study, whether for interest, post-secondary requirements or vocational needs.

Minimum Expectations for Skill Development and Cultural Understanding.

Grades 10, 11, and 12

The following minimum expectations for skill development and cultural understanding are considered to be part of the core or mandatory content.

Listening Comprehension

With the successful completion of this program, the student will have developed the ability to:

1. Distinguish phonetic and phonemic differences within the Spanish sound system;
2. Distinguish Spanish intonation and stress patterns;
3. Demonstrate understanding of familiar questions, statements and instruction which incorporate the basic elements of the program as specified in the curriculum guide;
4. Demonstrate understanding of new combinations of structures and vocabulary of the program;
5. Understand various speakers in structured situations;
6. Listen to weather reports, newscasts, speeches and stories, and answer general questions, orally or in writing;
7. Identify gestures and visual clues which convey a message.

Speaking

With the successful completion of this program, the student will have developed the ability to:

1. Produce, with reasonable accuracy, Spanish sounds, intonation, rhythm, stress and linking patterns;
2. Respond orally using the basic linguistic elements of the program;
3. Produce a sentence by combining known elements;
4. Describe a familiar situation;
5. Relate a sequence of actions;
6. Summarize the main ideas of a familiar situation within the range of one's language experience;
7. Ask for information;
8. Express one's own ideas and feelings within the range of one's language experience and areas of interest;
9. Interview someone using the basic elements of the program;
10. Explain how to do something such as cook, assemble, construct, sew, repair or play an instrument;
11. Speak with prior preparation on a selected topic.

Reading

With the successful completion of this program, the student will have developed the ability to:

1. Read aloud combinations of familiar material, demonstrating correct sound-symbol correspondences, word groupings, basic intonation patterns and rhythm;
2. Read aloud materials containing some new semantic elements, demonstrating the ability to apply generalizations about sound-symbol correspondences, word groupings, basic intonation patterns and rhythm;
3. Read silently with comprehension;
    - 3.1 familiar material learned orally,
    - 3.2 combinations and rearrangements of familiar material,
    - 3.3 material containing cognates, punctuation, contextual clues and a limited number of unfamiliar lexical items;
4. Read for information based on themes for which vocabulary has been learned;
5. Demonstrate comprehension of a passage read by answering questions or by citing evidence to support conclusions;
6. Skim for comprehension major ideas contained in a short text;
7. Read newspaper and magazine articles for information and/or pleasure;
8. Use a unilingual Spanish and a Spanish-English dictionary effectively.

Writing

With the successful completion of this program, the student will have developed the ability to:

1. Write from dictation sentences containing recombinations of learned written materials;
2. Answer in writing given questions;
3. Produce new combinations or variations from given elements;
4. Express himself/herself in simple original sentences within the limits of the linguistic content specified in the program;
5. Make required variations (time, person, number) in given sentences;
6. Write a sequence of sentences from a given outline, from a list of linguistic elements or from visual and oral cues;
7. Write a letter to a friend.

Cultural Understanding

With the successful completion of this program the student will demonstrate knowledge of:

1. Hispanic cultures;
2. Some differences and similarities between these cultures and his own;
3. Cultural connotation of familiar vocabulary;
4. The ability to use social conventions, gestures, facial expressions, intonation and stress patterns employed by a speaker to convey his intentions, feelings and emotions.

C. CONTENT

The objectives and content are selected on the basis of categories of language uses. Examples are:

1. Social Conventions
2. Identification of Persons and Things
3. Expressing Actions
4. Expressing Location
5. Expressing Time
6. Expressing Possession
7. Expressing Quantity
8. Expressing Permission and Desire
9. Describing People and Things
10. Expressing Emotions and Attitudes
11. Expressing Relationships
12. Expressing Cause and Effect

These language functions are considered to be the main categories of verbal communication. In the classroom, each of the above categories may be realized separately or in various combinations. In this program, expected verbal performances and linguistic content are specified for each category.

Performance Statements

The performance statements indicate the minimum that students are expected to **do** in verbal communication in the second language.

Linguistic Content

The linguistic content identifies the minimum language structures, sentence patterns, changes in word forms, and vocabulary that students are expected to acquire in order to engage in verbal communication.

The categories of language use, the performance statements and linguistic content for each grade level are not arranged in a sequential order, although it is recommended that the specified objectives and content be covered by the end of each grade. It is expected that the content specified in the categories of language use and the skills described in the performance statements and general objectives be mastered by the end of Grade 12.

Suggested Vocabulary

The vocabulary is suggested for development of everyday themes and is intended to complement the vocabulary found in primary learning resources. These lists are an additional source for teacher reference and are considered to be elective.

Major Cultural Themes

The major cultural themes of this program are to be developed as part of the core content, but specific topics within each theme are elective. The major cultural themes include:

1. Social relations at the individual level, the family and the community;
2. Economic and political aspects of Hispanic life;
3. Education and cultural features of Hispanic life;
4. Aspects of history and geography of the Hispanic people;
5. Art and play.

In Summary, the Core Components Consist of:

1. The general objectives for skill development and cultural understanding;
2. The content specified in the categories of language use;
3. The skills and concepts identified in the performance statements;
4. The major cultural themes.

The Elective Components Consist of:

1. The suggested vocabulary;
2. The specific topics within the cultural themes.

D. LEARNING RESOURCES

I. Prescribed

1. *Ambientes hispánicos.* Levels 1 and 2. St. Paul, Minn.: EMC Corporation, 1980.
2. *Invitación al español: Usted ty yo; Nuestro mundo.* New York: Macmillan Publishing Company, 1975.

II. Recommended

Schmitt, C., Woodford, P. and Marshal, R. *Español: a descubrirlo; Español: a sentirlo.* Levels 1 and 2. 4th ed. New York: McGraw-Hill Book Company, 1977.

GERMAN AS A SECOND LANGUAGE

The three-year program for German as a second language (German 10, 20 and 30) is designed for school jurisdictions which offer only a minimal program at the high school level.

It presupposes that individual communication (for example, giving personal information or expressing a desire to do something) is best realized through the use of those linguistic structures and vocabulary items which are appropriate to the social context of a situation.

In such an approach, the grammar of a language is a means to an end; that is, communication, rather than an end in itself. The selection of the structural features for cognitive understanding, practice and free usage is based on meaningful themes. This approach is in contrast to that used in traditional grammar-based resources which, although exhaustive and well-organized in their presentation of structural features within a given lesson, often lack a direct relationship to actual language usage that would be apparent to the student. The communicative approach to learning and teaching a second language does not exclude the explicit and deliberate treatment of grammar, but subordinates it to the needs of a particular situation. While practising a particular language structure, a student would be thinking in terms of expressing an idea rather than in terms of learning an abstract grammatical form.

Ten basic categories of language use have been identified and are subdivided into 63 themes. Examples of their realization through language are given as "linguistic content".

The program includes:

1. Program goals which reflect the Goals of Basic Education together with a rationale to support the inclusion of German in the school program;
2. General objectives which specify the minimum expectations at the end of German 30 for each language skill (listening, speaking, reading and writing) as well as for cultural understanding;
3. Specific themes and performance statements for each grade level;
4. Linguistic content within a given grade level;
5. Specification of core and elective components.

A. RATIONALE

To avoid isolation, a country must provide through its centres of education opportunities for learning and teaching various second languages. Among the many existing languages and their respective cultures, the German heritage has always played a significant part in the Canadian mosaic.

German is the sixth most used language in the world. It is spoken by approximately 110 million people. Of these, 62 million live in the Federal Republic of Germany, 17 million in the German Democratic Republic, 7 million in Austria, 4 million in Switzerland and a substantial number in the Americas, in Australia and in South and East Africa. According to the Canadian Census of 1981, speakers of German form the fourth largest ethnic group in Canada and the second largest in Alberta. The Canadian student of German is learning a language used by thousands of Canadians, and opportunities exist to speak with people who use German for everyday communication. In Canada, several newspapers are published regularly in German; radio and television programs are broadcast in this language, and German movies are shown frequently in the larger urban centres.

The purposes for which a student may learn a second language can be grouped hierarchically according to one's needs regarding the self, family and society. Satisfaction of these needs on the individual level will have very positive effects at the societal level. An individual's needs may be identified with respect to:

Self

1. to be able to communicate with native speakers in the other country while travelling for business or pleasure;
2. to gain insight into one's first language by acquiring a knowledge of the structure of a second language;
3. to satisfy one's curiosity about a foreign culture and its value system;
4. to become knowledgeable, as part of a general education, about people and institutions in other cultures, thereby gaining better insights into one's own culture;
5. to develop an appreciation of works of art or other cultural contributions;
6. to fulfil educational requirements, such as admission to university;
7. to enhance one's career/job prospects: for example, providing translation services to business and government; in the tourist trade; the export and import business; in advertising; the airlines; foreign service; immigration, social work and health services; in the media; in library work, or publishing; in scientific and technical research; secretarial/executive skills; and in teaching at the elementary, secondary and post-secondary levels.

Family

1. to communicate with members of one's family from the "old country";
2. to understand better one's family heritage in Canada and to preserve that heritage for future generations.

Society

1. to be able to satisfy the requirements of various institutions of Canadian society, such as government, business and education;
2. to be able to contribute to a multicultural society which attempts to foster understanding among the people of the world.

B. GOALS AND OBJECTIVES

Goals determine the broad, long-range outcomes of a program.

Although the following goals may be given varying emphasis, they are identified as those appropriate to learning German and are intended to enable the student:

1. To acquire basic communication skills in German by
    - 1.1 developing the receptive skills of listening and reading, including an understanding of intonation, gestures and visual clues which help to convey the message;
    - 1.2 developing the productive skills of speaking and writing including the appropriate intonation, gestures and visual clues which help to convey the message fluently and accurately.
2. To broaden personal perspectives and to develop cultural sensitivity by
    - 2.1 developing a greater awareness and appreciation of various cultural values and lifestyles;
    - 2.2 becoming more aware of Canada's multicultural heritage through the study of German;
    - 2.3 developing a positive attitude toward people who speak another language through a variety of exposures to the German language and culture;
    - 2.4 becoming aware of and appreciating, through instruction and direct experiences, the valuable contributions of German-speaking peoples to culture and civilization;

- 2.5 expanding them to include the national and international scene through active participation in a language spoken by many Canadians;
- 2.6 beginning to acquire those skills needed to function and communicate within a German-speaking society.

3. To develop originality and creativity in language by
   - 3.1 facilitating the application of the language skills to new and meaningful situations;
   - 3.2 facilitating the expression of personal ideas, feelings and attitudes.

4. To acquire additional concepts and generalizations about language and language learning by
   - 4.1 recognizing the basic structural similarities and differences between German and English;
   - 4.2 acquiring some knowledge of the structure and function of languages;
   - 4.3 developing an awareness of regional, social and functional variations of spoken and written language;
   - 4.4 developing a conscious knowledge of the skills and strategies used in learning a second language.

5. To develop a desire to extend or improve one's proficiency in languages through further study whether for interest, post-secondary requirements or vocational needs.

Minimum Expectations for Skill Development and Cultural Understanding

The following minimum expectations for skill development and cultural understanding are considered to be part of the core or mandatory content.

1. Listening Comprehension

With the successful completion of this program, the student, by listening, will have developed the ability to:

1. Distinguish phonemic differences within the German sound system;
2. Distinguish German intonation and stress patterns;
3. Demonstrate understanding of familiar questions, statements, and instructions which incorporate the basic elements of the program as specified in the curriculum guide;
4. Demonstrate understanding of new combinations of structures and vocabulary of the program;
5. Understand various speakers in structured situations;
6. Recognize specific information and ideas within a given context;
7. Understand information in material containing cognates and a limited number of unfamiliar lexical items by inferring meaning from the context.

2. Speaking

With the successful completion of this program, the student will have developed the ability to:

1. Produce comprehensible German sounds, intonation, rhythm, stress and elision with reasonable accuracy;

2. Respond to cues which require the use of the basic linguistic elements of the program;
3. Produce meaningful utterances by recombining known elements;
4. Describe a familiar situation;
5. Relate a sequence of actions;
6. Ask for information;
7. Interview someone using the basic elements of language;
8. Speak with prior preparation on a selected topic;
9. Participate in a simple conversation or discussion on a familiar topic;
10. Express some personal ideas, feelings and attitudes.

3. Reading

With the successful completion of this program, the student will have developed the ability to:

1. Read familiar materials silently, with comprehension;
2. Read aloud, familiar materials and global expressions with comprehension, correct rhythm and pronunciation;
3. Read with comprehension, recombinations and rearrangements of familiar materials;
4. Read, for general meaning, material containing some unfamiliar cognates or vocabulary items;
5. Read for specific information and ideas;
6. Read for major ideas contained in a short text;
7. Read simple newspaper and magazine articles and/or stories for pleasure.

4. Writing

With the successful completion of this program, the student will have developed the ability to:

1. Produce meaningful combinations or variations of given elements;
2. Write, from dictation, sentences containing recombinations of learned written materials;
3. Write a guided composition;
4. Describe a familiar situation;
5. Relate a sequence of actions;
6. Summarize a passage heard or read;
7. Write a letter to a friend.

5. Cultural Understanding

With the successful completion of this program, the student will demonstrate an understanding and appreciation of:

1. German-speaking cultures in Canada, Germany and other countries;
2. Some differences and similarities between the learner's culture and the various German-speaking cultures;
3. The significance of social conventions, simple gestures, facial expressions, intonation and stress used by the speaker to convey intentions, feelings or attitudes;
4. Cultural connotations of familiar vocabulary and expressions.

C. CONTENT

Categories of Language Use

The objectives and content are selected on the basis of categories of language use. They are:

1. Social Conventions
2. Identification of Persons, Animals and Things
3. Expressing Actions
4. Expressing Location
5. Expressing Time
6. Expressing Possession
7. Expressing Manner and Means
8. Expressing Modes of Action
9. Expressing Emotions and Attitudes
10. Expressing Cause and Effect

These language functions are considered to be the main categories of verbal communication. In the classroom, each of the above categories may be realized separately or in various combinations. Examples of expected verbal performances in themes and linguistic content are specified for each category.

Themes

The themes indicate the minimum social interactions in which the students should be able to communicate in German.

Linguistic Content

The linguistic content identifies the minimum language structures, sentence patterns, and vocabulary that students are expected to acquire.

The categories of language use, the themes and linguistic content for each grade level are not arranged in any prescribed sequence although it is recommended that the specified objectives and content be covered by the end of each grade. It is expected that the content specified in the categories of language use, the skills described in the themes listed in the linguistic content, and minimum expectations be mastered by the end of German 30.

Suggested Basic Vocabulary

The vocabulary list contains the items in the linguistic content of the guide and other words which are expected to be acquired by students successfully completing this program.

Culture

Cultural themes and topics are presented to assist the student in the development of insights into the ways of life of German-speaking peoples as well as the acquisition of knowledge about their achievements and contributions to culture and civilization. Specific cultural topics are considered to be elective.

In Summary, the Core Components Consist of:

1. The minimum expectations for skill development and cultural understanding;
2. The skills and concepts identified in the themes contained in the curriculum guide;
3. The linguistic content specified for the three-year program;
4. The major cultural themes.

The Elective Components Consist of:

1. The suggested basic vocabulary;

2. Specific topics related to major cultural themes;
3. The suggested classroom expressions.

D. LEARNING RESOURCES

I. Prescribed

1. *Unsere Freunde/Die Welt der Jugend.* Levels I and II. New York: Harcourt Brace Jovanovich, 1978.
2. *Vorwärts K1, K2, K3A.* Bonn: Gilde Buchhandlung Carl Kayser, 1977-1980.

LATIN AS A SECOND LANGUAGE

A. OBJECTIVES

The specific objective of a program in any second language is to enable the learner to acquire a proficiency in a language other than his or her own tongue. For the study of Latin, this takes the form of gaining proficiency in:

a) reading and understanding Latin;

b) learning more about one's own language;

c) learning about the ancient world and its values;

d) comparing and contrasting one's own values with those of the ancient world;

e) appreciating the immense contribution of Latin to the English vocabulary.

B. RECOMMENDED LEARNING RESOURCES

Cobban, J.M. and Colebourne, R. *Civis Romanus*. 14th ed. London: Methuen, 1974.

Collins Latin Gem Dictionary. London: William Collins Sons & Co., 1980.

Jenny, C. *First Year Latin*. Toronto: Allyn & Bacon, 1979.

Taylor, B.C. and Prentice, K.E. *Selected Latin Readings*. Toronto: Dent, 1980.

NOTE: 1. Teachers are encouraged to utilize a large number of resource materials which emphasize the development of reading comprehension. The materials listed above are recommended for this purpose. Of those, only *Selective Latin Readings* by Taylor and Prentice can be obtained through the Alberta School Book Branch. The others are available through the publisher.

2. Students who have successfully completed the minimum content suggested for the junior high school Latin program should register in Latin 20.

Teachers who are recommending students for Latin 20 should ensure that the suggested course content for Latin 10 as outlined in the program of studies has been completed.

MATHEMATICS

Goals of the Senior High School Mathematics Program

Although the different courses of the senior high school mathematics program have different specific objectives, the goals of the senior high mathematics program are set forth in relation to three main expectations and needs: those of the individual, those of the discipline of mathematics and those of society at large. They are listed as follows:

Student Development

- a. To develop in each student a positive attitude towards mathematics.
- b. To develop an appreciation of the contribution of mathematics to the progress of civilization.
- c. To develop the ability to utilize mathematical concepts, skills and processes.
- d. To develop the powers of logical analysis and inquiry.
- e. To develop an ability to communicate mathematical ideas clearly and correctly to others.

Discipline of Mathematics

- a. To provide an understanding that mathematics is a language using carefully defined terms and concise symbolic representations.
- b. To provide an understanding of the concepts, skills and processes of mathematics.
- c. To provide an understanding of the common unifying structure in mathematics.
- d. To furnish a mode of reasoning and problem solving with a capability of using mathematics and mathematical reasoning in practical situations.

Societal Needs

- a. To develop a mathematical competence in students in order to function as citizens in today's society.
- b. To develop an appreciation of the importance and relevance of mathematics as part of the cultural heritage that assists people to utilize relationships that influence their environment.
- c. To develop an appreciation of the role of mathematics in man's total environment.

Mathematics 10-20-30; 31

This sequence of courses is designed for academically-oriented students intending to pursue post-secondary studies at a university or technical institute. Mathematics 10-20-30 emphasizes the theoretical development of mathematics concepts and relationships through deductive reasoning. Mathematics 31 is a course for students with strong mathematical abilities and interests and focuses on introductory calculus and vectors. Mathematics 30 is a requirement for the Advanced High School Diploma.

Mathematics 13-23-33

This sequence of courses places emphasis on inductive, experimental approaches to the understanding and assimilation of mathematics subject matter. It is designed as an academic program with similar content to that of Mathematics 10-20 but extended over a longer time frame for students requiring a less rigorous approach. Upon successful completion of Mathematics 33, students may cross over to Mathematics 30 to meet the Advanced High School Diploma requirements.

Mathematics 15-25

This sequence of courses is designed for students who have experienced difficulties in mastering mathematics at previous grade levels but require a Grade 10 level course for the General High School Diploma. The program should be success oriented.

Problem Solving

A major component of all senior high school mathematics programs is the further development and maintenance of problem solving skills developed in the earlier grades. The following four steps and strategies have been accepted as a general framework toward the development of problem solving abilities.

Stages

Understanding the Problem. Strategies in this stage include:

- Paraphrasing the problem or question.
- Identifying given, needed, and extraneous information.
- Making a drawing.
- Using simulations or models.
- Checking for hidden assumptions.

Devising a Plan to Solve the Problem:

- Solving a simpler (or similar) problem.
- Constructing information tables, charts and graphs.
- Looking for patterns or a trend.
- Solving parts of the problem.
- Making diagrams, models.
- Guessing and checking.
- Changing your point of view.
- Writing mathematical sentences or equations.

Carrying Out the Plan:

In the general framework the "carrying out the plan" stage is merely doing what was planned in stage two. If the plan does not work, the problem solver should revise the plan, review stage one and/or try another plan or combination of plans from stage two.

Looking Back. Strategies in this stage include:

- Communicating the solution.
- Generalizing the solution.
- Checking the solution for reasonableness.
- Finding alternative solution.
- Checking for more than one solution.
- Evaluating the solution process.

Teachers are advised to consult the curriculum guide for further information concerning the four problem solving stages and associated strategies.

MATHEMATICS 10-20-30

Learning Resources

Mathematics 10

Prescribed:

Holt Mathematics 4. M. P. Bye, T. J. Griffiths, A. P. Hanwell. Toronto: Holt, Rinehart and Winston of Canada Ltd., 1980.

Math is 4. F. Ebos, B. Tuck. Don Mills: Nelson Canada, 1979.

Recommended:

Foundations of Mathematics for Tomorrow: Introduction. D. Dottori, R. McVean, G. Knill, J. Seymour. Toronto: McGraw-Hill Ryerson Limited, 1974.

Mathematics 20

Prescribed:

Math is 5. F. Ebos, B. Tuck. Nelson Canada, 1980.

Holt Mathematics 5. K. D. Fryer, R. G. Dunkley, H. A. Elliott, N. J. Hill, R. J. MacKay. Holt, Rinehart and Winston of Canada Ltd., 1980.

Recommended:

Foundations of Mathematics for Tomorrow: Intermediate. D. Dottori, G. Knill, J. Stewart. McGraw-Hill Ryerson Limited, 1978.

Mathematics 30

Prescribed:

Math is 6. F. Ebos, B. Tuck. Nelson Canada, 1982.

Foundations of Mathematics for Tomorrow: Senior. D. Dottori, G. Knill, J. Stewart. McGraw-Hill Ryerson Limited, 1979.

Recommended:

Holt Mathematics 6. K. D. Fryer, R. G. Dunkley, H. A. Elliott, N. J. Hill, R. J. MacKay. Holt, Rinehart and Winston of Canada Ltd., 1981.

CORE OBJECTIVES FOR MATHEMATICS 10

I. Core Component*

A. Number Systems

1. Identify numbers as natural, whole, integral and rational.
2. Add, subtract, multiply and divide rational numbers.
3. Convert a rational number from decimal form to fraction form $\frac{a}{b}$ and vice versa.
4. Apply percentage to consumer-related problems:
    a. simple interest
    b. discounts and mark-ups
    c. commissions
5. Apply percentage to the calculation of compound interest.
6. Identify rationals as:
    a. infinite repeating decimals
    b. terminating decimals

7. Identify irrationals as:
    - a. infinite non-repeating decimals
    - b. square roots of numbers which are not perfect squares
    - c. special cases such as π
8. Represent the relation between natural numbers, whole numbers, integers, rationals, irrationals and reals by a pictorial diagram.

B. Equations and Graphing

1. Maintain skills in solving first degree equations with rational coefficients.
2. Solve word problems whose solutions are based on first degree equations with rational coefficients.
3. Identify and use the terms: quadrant, origin, axis, coordinate, ordered pair, abscissa and ordinate.
4. Recognize and graph ordered pairs.
5. Interpret graphs of straight lines.
6. Graph linear equations using:
    - a. ordered pairs
    - b. intercepts
7. Find the intercepts of a line:
    - a. by examining its graph
    - b. from its equation
8. Apply the skills of graphing to practical problems involving two linear equations.

C. Presentation of Data and Descriptive Statistics

1. Organize data by:
    - a. collecting various types of data
    - b. grouping data into classes
    - c. determining frequency of each class
    - d. defining class width (interval), class boundaries, and class marks
2. Graph data using bar graphs, circle graphs, histograms and frequency polygons.
3. Calculate the mean, median and mode for ungrouped (raw) data.
4. Select the most suitable of three types of averages for a given set of ungrouped data.
5. Select a suitable sample from a given population.

D. Variation

1. Identify direct variation.
2. Identify inverse variation.
3. Identify partial variation.
4. Solve problems based on direct, inverse and partial variation.
5. Find the constant of proportionality for a given variation.

E. Exponents and Radicals

1. Utilize the following laws of exponents:

   Where a, b, ε I; x, y ε R; $x \neq 0$, $y \neq 0$

   $x^a \cdot x^b = x^{a+b}$

   $x^a \div x^b = x^{a-b}$

   $(x^a)^b = x^{ab}$

   $(xy)^a = x^a y^a$

   $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$

   $x^0 = 1$

   $x^{-a} = \frac{1}{x^a}$

2. Transform a number in decimal form to scientific (standard) notation and vice versa.
3. Perform the operations of multiplication and division on numbers expressed in scientific (standard) notation.
4. Use the laws of exponents, where the exponents are ½ and ⅓.
5. Identify and use the terms radical, radicand and radical sign.
6. Utilize the definition

   $$x^{\frac{a}{b}} = \sqrt[b]{x^a} = \left(\sqrt[b]{x^a}\right)$$

   where b = 2, 3, x ε R
7. Simplify radical expressions of the form

   $\sqrt[b]{x}$, where b = 2
8. Perform the four basic operations on radicals of the form

   $\sqrt[b]{x}$, where b = 2
9. Rationalize radical denominators that are monomials.

F. Polynomials

1. Identify and use the following terms:
   - a. algebraic expression
   - b. term
   - c. factor
   - d. monomial
   - e. binomial
   - f. trinomial
   - g. polynomial
   - h. coefficient
   - i. degree
2. Evaluate a polynomial for given values of the variables.
3. Add and subtract polynomials.
4. Multiply:
   - a. monomial x monomial
   - b. monomial x binomial
   - c. monomial x trinomial
   - d. binomial x binomial

5. Write the expansions of

   $(P + Q)^2$, $(P - Q)^2$ and

   $(P - Q) \cdot (P + Q)$

   and recognize them as general cases.
6. Recognize and factor a polynomial with a common factor where the common factor is:
   - a. a monomial
   - b. a binomial
7. Factor a trinomial of the form

   $ax^2 + bx + c$

   where $a, b, c \varepsilon I$, $a \neq 0$
8. Factor polynomials of the form

   $P^2 - Q^2$
9. Factor polynomials by using any combination of the methods outlined in objectives 6 through 8.
10. Divide a polynomial by:
    - a. a monomial
    - b. a binomial
11. Simplify rational expressions by factoring.
12. Perform the operations of multiplication and division with rational expressions.
13. Perform the operations of addition and subtraction of rational expressions with:
    - a. the same denominator
    - b. different denominators
14. Determine permissible and non-permissible values of the variables in rational expressions.
15. Determine the zeros of a polynomial of one variable by factoring.
16. Solve equations involving rational expressions.

G. Trigonometry

1. Find the unknown sides in similar triangles.
2. Apply similar triangles to practical problems.
3. Define sine, cosine and tangent ratios for right angle triangles.
4. Find the trigonometric ratios of the acute angles in a right triangle when the sides are given.
5. Determine the trigonometric ratios of any given acute angle.
6. Determine the measure of any acute angle given one of its trigonometric ratios.
7. Solve problems based on right triangles using trigonometric ratios.

H. Geometry

1. Recognize and use the following terms: vertex, side (ray), degree, straight angle, right angle, acute angle, obtuse angle, reflex angle, adjacent angle, complementary angle and supplementary angle.
2. Recognize and use the following terms associated with triangles: equilateral, equiangular, isosceles, scalene and right triangles, hypotenuse.

3. Use the Pythagoras theorem to solve right triangles and associated problems.
4. Recognize and use the following terms associated with polygons: quadrilateral, trapezoid, parallelogram, rectangle, rhombus, square, regular polygon, and diagonal.
5. Recognize and use the following terms associated with parallel lines: transversal, corresponding angles, alternate angles and interior angles.
6. Recognize and use the following terms: congruency, similarity, perpendicular, bisector and perpendicular bisector.
7. Measure an angle with a protractor.
8. Construct an angle congruent to a given angle.
9. Construct the bisector of a given angle.
10. Construct a perpendicular to a given line segment:
    - a. at a given point on a segment
    - b. through a point not on the same segment
11. Construct the right bisector of a segment.
12. Construct a line parallel to a given line.
13. Recognize that a formal axiomatic development requires:
    - a. undefined terms
    - b. definitions
    - c. assumptions (postulates or axioms)
    - d. theorems
14. State, prove and apply these basic theorems of geometry:
    - a. vertically opposite angle theorem
    - b. congruence of triangles using SAS, ASA, SSS
    - c. isosceles triangle theorem
    - d. parallel line theorems
    - e. the sum of the measure of the interior angles of a triangle is 180°
15. Apply the basic theorems to solve problems involving numerical application.

***Note:** The Mathematics 10 course does not include an elective component.

CORE OBJECTIVES FOR MATHEMATICS 20

I. Core Component

A. Radicals

1. Maintain previous skills.
2. Simplify radical expressions of the form $\sqrt[b]{x}$, $b = 2, 3$.
3. Perform the four basic operations on radicals.
4. Rationalize radical denominators that are monomials and binomials.
5. Solve radical equations containing one radical in one variable.
6. Solve radical equations containing two radicals in one variable.

B. Polynomials

1. Maintain previous skills in algebraic operations.
2. Maintain previous skills of factoring.

3. Maintain previous skills of solving linear equations with one unknown.
4. Factor polynomials of the form $P^3 \pm Q^3$
5. Factor polynomials which are incomplete squares.
6. Factor polynomials by the grouping method.

C. Coordinate Geometry

1. Maintain previous skills related to the following: quadrants, axes, origin, ordered pairs and intercepts.
2. Determine the distance between two points.
3. Determine the coordinates of the midpoint of a line segment.
4. Determine the slope of a line passing through two given points.
5. State the relationship between slopes of:
   - a. parallel lines
   - b. perpendicular lines
6. Graph lines whose equations are in the form $Ax + By + C = 0$ or $y = mx + b$ using the slope and y-intercept.
7. Use the slope test to determine whether three points are collinear.
8. Write an equation and draw the graph of:
   - a. a vertical line
   - b. a horizontal line
9. Write an equation of a line and draw its graph given the slope and a point on the line.
10. Write the equation of a line passing through a given point and:
    - a. parallel to a given line
    - b. perpendicular to a given line
11. Given two points:
    - a. draw the graph of the line passing through them
    - b. write the equation of the line passing through them

D. Presentation of Data and Descriptive Statistics

1. Maintain previous skills of organizing ungrouped (raw) data.
2. Calculate the mean, median and mode for grouped data.
3. Draw histograms and cumulative frequency histograms (ogives).
4. Demonstrate how to obtain and interpret quartiles and percentiles (graphically and from grouped data).

E. Relations and Functions

1. Define a relation.
2. Define the domain and range of a relation.
3. Determine the inverse of a relation.
4. State the relationship between the domain and range of a relation and the domain and range of its inverse.
5. State the relationship between the graph of a relation and the graph of its inverse.
6. Define a function.
7. Use the functional notation f(x) in defining a function.

8. For particular values of x, find f(x).
9. Define and graph a linear function.

F. Quadratic Functions, Equations and Applications

1. Identify and express quadratic functions in the form $y = ax^2 + bx + c$ where $a, b, c \in R$, $a \neq 0$.
2. Identify and express quadratic equations in the form $ax^2 + bx + c = 0$ where $a, b, c \in R$, $a \neq 0$.
3. Graph a quadratic function using a table of values.
4. Find the vertex, axis of symmetry, domain, range and maximum or minimum value of a quadratic function from its graph.
5. Use the formula for vertex and axis of symmetry if the quadratic function is given in the form $y = ax^2 + bx + c$.
6. State the relationship between the graph of a quadratic function and the roots of the corresponding equation.
7. Write quadratic equations in the form $ax^2 + bx + c = 0$ and specify the value of a, b, c.
8. Use the method of completing the square of a quadratic function to find the vertex, axis and symmetry, range and maximum or minimum value. Draw the graph using this information.
9. Solve problems involving the maximum or minimum value of a quadratic function.
10. Compute the real roots of a quadratic equation by:
    a. factoring
    b. using the quadratic formula
    c. completing the square
11. Define and evaluate the discriminant of a quadratic equation.
12. State the nature of the roots by examining the discriminant.
13. Solve problems whose solutions are based on quadratic equations.

G. Systems of Equations

1. Solve linear systems of equations both algebraically and graphically.
2. Identify systems as having many solutions, one solution or no solution.
3. Solve problems based on the solution of systems of equations.
4. Solve linear-quadratic and two-quadratic systems.

H. Geometry

1. Define and illustrate the following terms related to the circle: radius, chord, interior, exterior, arc, semicircle, segment, sector, central angle, inscribed angle, secant line and tangent line.
2. Apply the following basic theorems:
    a. a line containing the centre of a circle that bisects a chord, which is not a diameter, is perpendicular to that chord (include corollaries)
    b. a tangent line is perpendicular to the radius drawn to the point of contact
    c. the measure of an inscribed angle is half the measure of the central angle subtended by the same arc (or congruent arcs)
    d. the angle between the tangent and the chord is one-half the measure of the intercepted arc
3. Construct a tangent to a circle from a given point.

4. Find the length of an arc given the measures of the central angle and the radius.
5. Find the area of a sector given the measures of the central angle and the radius.
6. Solve problems involving numerical applications of the above theorems.

I. Trigonometry

1. Maintain previously developed skills in solving right triangles.
2. Identify cosecant, secant and cotangent ratios as reciprocal ratios of sine, cosine and tangent.
3. Determine the relative measures of the sides of:
   a. a 30 - 60 - 90 triangle
   b. a 45 - 45 - 90 triangle
4. Solve the right triangles using any of the trigonometric ratios.
5. Solve the problems involving right triangles including:
   a. angles of elevation and depression
   b. three dimensions
   c. more than one triangle

J. Variation

1. Maintain previous skills of direct, inverse and partial variation.
2. Identify joint variation.
3. Solve problems related to joint variation.

II. Elective Component

The following topics are suggested as possible elective topics in Mathematics 20. Teachers may choose one or more of these topics or incorporate their own ideas. **The elective is a mandatory component (approximately 15%) of the Mathematics 20 course.**

Topics:		
	Absolute Value	Linear Programming
	Complex Numbers	Math Art
	Inequalities	Transformation Geometry

Outlines and suggested learning resources for each of the elective topics listed are provided in the 1983 curriculum guide for Mathematics 10-20-30.

CORE OBJECTIVES FOR MATHEMATICS 30

I. Core Component

A. Trigonometry

1. Maintain previously developed skills.
2. Describe circular paths using the initial point and directed distance of the path.
3. Define the unit circle $x^2 + y^2 = 1$.
4. Determine coordinates of points on the unit circle.

5. Define the trigonometric ratios in terms of coordinates of points on the unit circle.
6. Find the domain and range of the six trigonometric ratios.
7. Solve simple trigonometric equations.
8. Given the value of one of the trigonometric ratios, evaluate the other five trigonometric ratios.
9. Derive and apply the following identities:
   a. quotient relations:

      $\tan\theta = \frac{\sin\theta}{\cos\theta}, \cot\theta = \frac{\cos\theta}{\sin\theta}$

   b. reciprocal relations:

      $\csc\theta = \frac{1}{\sin\theta}$

      $\sec\theta = \frac{1}{\cos\theta}$

      $\cot\theta = \frac{1}{\tan\theta}$

   c. pythagorean relations:

      $\sin^2\theta + \cos^2\theta = 1$

      $1 + \tan^2\theta = \sec^2\theta$

      $1 + \cot^2\theta = \csc^2\theta$

10. Derive and apply the following identities:
    a. negative arc formulas:

       $\sin(-\theta) = -\sin\theta$
       $\cos(-\theta) = \cos\theta$
       $\tan(-\theta) = -\tan\theta$

    b. sum formulas:

       $\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$

       $\cos(A \pm B) = \cos A\cos B \pm \sin A\sin B$

    c. complementary arc formulas:

       $\cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta$

       $\sin\left(\frac{\pi}{2} - \theta\right) = \cos\theta$

11. Draw and identify graphs of the sine, cosine and tangent functions.
12. Define periodic function and state the periods of $\sin\theta$, $\cos\theta$ and $\tan\theta$.
13. Define radian measure.
14. Convert degree measure to radian measure and vice versa.
15. Determine exact values of trigonometric ratios of 0°, 30°, 45°, 60° and 90°.
16. Determine the value of a trigonometric ratio of any angle.
17. Solve oblique triangles by using the Sine law and/or Cosine law.
18. Apply the Sine law and Cosine law to practical problems.
19. Solve problems involving areas of regular polygons.

B. Quadratic Relations (Conic Sections)

1. Maintain previous skills in analytic geometry:
   - a. linear functions and slope
   - b. distance and midpoint formulas
   - c. properties of tangents
   - d. solution of systems of equations in two variables
2. State the definition of the circle and derive the standard form.
3. Convert the equation of a circle from standard to general form.
4. Determine the equation of a circle and sketch the graph given these conditions:
   - a. centre and radius
   - b. centre and a point
   - c. centre and equation of tangent line
   - d. three points on a circle
   - e. two points and equation of line containing the centre
5. Define and identify a parabola and the terms: focus, vertex, axis and directrix.
6. Derive the standard form of the equation of a parabola with a horizontal or vertical axis of symmetry.
7. Find the focus and directrix from the equation of a parabola.
8. Determine an equation and sketch the parabola, given:
   - a. focus and directrix
   - b. vertex and directrix
   - c. vertex and a point on the parabola
9. Solve applied problems related to the parabola.
10. Define and identify an ellipse and the terms: foci, major axis, minor axis, vertices, and focal radii.
11. Derive the standard form of the equation of an ellipse with foci on the x-axis or y-axis.
12. Given the equation of the ellipse determine: foci, vertices, major axis and minor axis.
13. Derive the relation between the parameters a, b and c for the ellipse. ($a^2 = b^2 + c^2$)
14. Determine an equation and sketch the ellipse given:
   - a. minor axis and distance between foci
   - b. vertices and foci
   - c. vertices and a point on the ellipse
15. Solve applied problems related to the ellipse.
16. Define and identify a hyperbola and the terms: vertices, foci transverse axis, conjugate axis and asymptotes.
17. Derive the standard form of the equation of a hyperbola with foci on the x-axis or the y-axis.
18. From the equation of the hyperbola find the foci, vertices, transverse axis, conjugate axis and asymptotes.
19. Derive the relation between the parameters a, b and c for the hyperbola. ($a^2 + b^2 = c^2$)

20. Determine an equation and sketch the hyperbola given:
    - a. transverse axis and conjugate axis
    - b. foci and length of one axis
    - c. equation of an asymptote and a point on the hyperbola
21. Solve applied problems related to the hyperbola.

C. Logarithms

1. Maintain previous skills on exponents.
2. Identify and graph exponential functions.
3. Convert equations from exponential form to logarithmic form and vice versa.
4. Solve logarithmic equations by converting to exponential form.
5. Define the inverse of an exponential function in logarithmic form.
6. Evaluate expressions and solve equations involving logarithmic form and exponential form.
7. State and use the basic laws or properties of logarithms for:
    - a. products
    - b. quotients
    - c. powers
    - d. roots
8. Use logarithms to solve practical problems.

D. Sequences, Series, Limits

1. Recognize:
    - a. the difference between a sequence and a series
    - b. the difference between a finite and infinite sequence
2. a. Recognize and define arithmetic sequences and series and state the common difference (d).
    - b. Derive and apply:
        - i. the general term formula

          $$a_n = a_1 + (n - 1)\,d$$

        - ii. the sum formula

          $$S_n = \frac{n}{2}(a_1 + a_n)$$

    - c. Apply formulas to problems involving arithmetic sequences and series.
3. a. Recognize and define geometric sequences and series and state the common ratio (r).
    - b. Derive and apply:
        - i. the general term formula

          $$a_n = a_1 r^{n-1}$$

        - ii. the sum formulas

          $$S_n = \frac{a_1(r^n - 1)}{r - 1} \quad r \neq 1$$

          $$S_n = \frac{ra_n - a_1,}{r - 1} \quad r \neq 1$$

c. Apply formulas to problems involving geometric sequences and series, with special emphasis being given to the mathematics of finance:
    - i. applications of simple and compound interest
    - ii. use tables to determine accumulated and present value accounts involving compound interest over different time periods
    - iii. illustrate the various annuities by using line diagrams
    - iv. apply geometric series to both accumulated and present value annuities with both identical and differing interest and payment periods

4. Generate the terms of a series using sigma notation (Σ).
5. Determine the limits of various functions.
6. Recognize the differences between infinite convergent and divergent sequences.
7. Find the limits of infinite convergent sequences.
8. Find the sums of infinite convergent series.
9. Solve problems involving infinite geometric series.

E. Presentation of Data and Descriptive Statistics

1. Maintain previously developed skills with ungrouped data and grouped data:
    - a. frequency distribution
    - b. measures of central tendency
    - c. measures of dispersion
2. Develop and apply standard deviation and z-scores.
3. Illustrate and develop the moral distribution.
4. Introduce probability using an experimental approach.
5. Apply probability to theoretical frequency distribution.

F. Polynomial Functions

1. Maintain previous skills with polynomials.
2. Classify a polynomial function according to degree.
3. Define integral polynomial functions.
4. Write polynomial functions (in descending order of degree) of the form

   $f(x) = a_o x^n + a_1 x^{n-1} + a_2 x^{n-2} \cdot \cdot \cdot + a_{n-1} x + a_n$

   $a_o \neq 0, n \varepsilon N$
5. Divide integral polynomial functions in one variable by a binomial of the form $x - a$, $a \varepsilon I$ using long division and synthetic division.
6. Evaluate integral polynomial functions for given values of the domain utilizing the Remainder Theorem.
7. Find factors of integral polynomial functions using the Factor Theorem.
8. Determine the x-intercepts of integral polynomial functions where $x \varepsilon Q$.
9. Sketch the graph of the integral polynomial functions using the intercepts.

II. Elective Component

The following topics are suggested as possible elective topics in Mathematics 30. Teachers may choose one or more of these topics or incorporate their own ideas. **The elective is a mandatory component (approximately 20%) of the Mathematics 30 course.**

Topics:	Arrangements and Selections	Probability
	History of Mathematics	Topology
	Mathematical Induction	Vectors
	Matrices	

Outlines and suggested learning resources for each of the elective topics listed are provided in the 1983 curriculum guide for Mathematics 10-20-30.

MATHEMATICS 31

A new course outline for Mathematics 31 has been approved for use on a mandatory basis, effective the 1984-1985 school term. Commencing with the 1985-86 school term, Mathematics 30 will form the prerequisite for Mathematics 31. Schools may register students in Mathematics 30 and 31 concurrently; that is, in the same term.

General Objectives

The general objectives of the high school mathematics program stated in the previous section apply to Mathematics 31. Following is a statement of the more specific objectives of the course:

1. To develop an understanding of the properties of functions and their role in many different areas of mathematics.
2. To increase the student's awareness of the scope of mathematics.
3. To prepare the student for further courses in calculus, vector analysis and related fields.
4. To develop skills that will increase a student's ability to simplify algebraic and numeric expressions.
5. To assist students to see that the mathematics of calculus and vectors have many practical applications.

Learning Resources

Prescribed:

Math 31. H. A. Elliott, K. D. Fryer, J. C. Gardner, Norman J. Hill. Toronto: Holt, Rinehart and Winston of Canada Ltd., 1984.

Calculus, Complex Numbers and Polar Coordinates. H. A. Elliott, K. D. Fryer, J. C. Gardner, Norman J. Hill. Toronto: Holt, Rinehart and Winston of Canada Ltd., 1980.

Vectors, Matrices and Algebraic Structures. H. A. Elliott, K. D. Fryer, J. C. Gardner, Norman J. Hill. Toronto: Holt, Rinehart and Winston of Canada Ltd., 1980.

Recommended:

*Computer Graphing Experiments, Volume 1**.

*Computer Graphing Experiments, Volume 2**.

*Computer Graphing Experiments, Volume 3**.

Don Mills: Addison-Wesley Publishers Limited, 1981.

*Computer Software Packages.

CORE OBJECTIVES FOR MATHEMATICS 31

I. Core Component

CALCULUS (50%)

A. Introduction to Calculus

1. Maintain previously developed skills in finding an equation of a line.
2. Define secant line.
3. Determine the equation of a secant line.
4. Define tangent line.
5. Define the limit of an infinite sequence.
6. Determine the limits of an algebraic function as the independent variable approaches a fixed value.
7. Verify the following limit theorems:
    - 7.1 $\underset{x \to a}{\text{limit}}\ k = k$, k is a constant
    - 7.2 $\underset{x \to a}{\text{limit}} \left[f(x) \pm g(x)\right] = \underset{x \to a}{\text{limit}}\ f(x) \pm \underset{x \to a}{\text{limit}}\ g(x)$
    - 7.3 $\underset{x \to a}{\text{limit}} \left[f(x)g(x)\right] = \left[\underset{x \to a}{\text{limit}}\ f(x)\right] \left[\underset{x \to a}{\text{limit}}\ g(x)\right]$
    - 7.4 $\underset{x \to a}{\text{limit}} \left[\frac{f(x)}{g(x)}\right] = \frac{\underset{x \to a}{\text{limit}}\ f(x)}{\underset{x \to a}{\text{limit}}\ g(x)}$ (if $\underset{x \to a}{\text{limit}}\ g(x) \neq 0$)
    - 7.5 $\underset{x \to a}{\text{limit}}\ k\left[f(x)\right] = k\left[\underset{x \to a}{\text{limit}}\ f(x)\right]$

B. Derivatives of Algebraic Relations

1. Define the derivative of a function in terms of limits.
2. Become familiar with a variety of derivative notations.
3. Develop the derivatives of the following functions from first principles using limits:
    - 3.1 linear
    - 3.2 quadratic
    - 3.3 cubic
    - 3.4 reciprocal
4. Determine the derivatives of algebraic functions by generalizing the results obtained from first principles.
5. Determine the slopes of tangent lines to functions.
6. Determine the equations of tangent lines to functions.
7. Derive the:
    - 7.1 power rule
    - 7.2 product rule for derivatives
    - 7.3 quotient rule for derivatives
8. Apply the chain rule, power rule, product rule and quotient rule.
9. Determine the derivatives of relations.
10. Determine the equations of tangent lines to relations.

C. Applications of Derivatives

1. Maxima and Minima
   - 1.1 Maintain previous skills in solving polynomial equations.
   - 1.2 Identify the domains for which the first derivative is greater than zero, less than zero or equal to zero.
   - 1.3 Define and identify maxima and minima using first and second derivatives.
   - 1.4 Identify formulae for perimeter, area and volume of various plane and solid figures.
   - 1.5 Solve applied problems.
2. Graphing
   - 2.1 Maintain previous skills of finding x and y intercepts of functions.
   - 2.2 Find the coordinates of any point where a relative maximum or minimum occurs.
   - 2.3 Define point of inflection.
   - 2.4 Find the coordinates of any points of inflection.
   - 2.5 Sketch a graph of polynomial functions identifying x and y intercepts, relative maxima, minima and any points of inflection.
3. Motion Problems
   - 3.1 Define average velocity and solve related problems.
   - 3.2 Define instantaneous velocity using limits and derivatives.
   - 3.3 Define acceleration and solve related problems.
   - 3.4 Define instantaneous acceleration using limits and derivatives.
   - 3.5 Solve applied motion problems using differentiation.
4. Related Rate Problems
   - 4.1 Use the chain rule for the differentiation of a function with respect to a variable not in the function.
   - 4.2 Interpret a derivative as a rate of change of one variable with respect to another.
   - 4.3 Solve applied problems using rates.

D. Integration

1. Define integration.
2. Find the family of curves whose first derivative has been given.
3. Find a specific member of a family of curves given the derivative and the coordinates of a point on a curve.
4. Solve applied motion problems.
5. Define and evaluate definite integrals.
6. Determine the area between a curve and the x-axis over a given domain:
   - 6.1 if f(x) has a constant sign in a given domain
   - 6.2 if f(x) changes sign in a given domain
7. Determine the area between two curves over a given domain.
8. Determine the area between two intersecting curves.

VECTORS

A. Geometric Vectors and Their Application

1. Maintain previous skill in trigonometry.
2. Define, sketch and apply three-dimensional geometric relationships.

3. Define and/or illustrate:
    - 3.1 geometric vectors
    - 3.2 equivalent vectors
    - 3.3 collinear and coplanar vectors
    - 3.4 vector addition
        - 3.4.1 for collinear vectors
        - 3.4.2 for non-collinear vectors
    - 3.5 inverse vectors
    - 3.6 scalar multiplication
    - 3.7 vector subtraction
4. Develop vector notation.
5. Illustrate graphically the following algebraic properties of vector addition:
    - 5.1 commutative property
    - 5.2 associative property
    - 5.3 identity property
    - 5.4 inverse property
6. Apply the algebraic properties of vector addition.
7. Apply the properties of multiplication by a scalar.
8. Apply vector addition to related problems, including definition of resultant and equilibrant.
9. Define and apply resolution of vectors into rectangular components.
10. Define and apply linear combinations of geometric vectors.

B. Algebraic Vectors and Their Application

1. Maintain previous skills in plotting points and finding the distance between two points in a plane.
2. Plot points and find the distance between two points in a three-dimensional system.
3. Define:
    - 3.1 algebraic vectors
    - 3.2 equivalent algebraic vectors
    - 3.3 zero vectors
    - 3.4 unit vectors
4. Define the following concepts:
    - 4.1 addition and subtraction of algebraic vectors
    - 4.2 scalar multiplication of algebraic vectors
5. Solve equations involving addition and subtraction of algebraic vectors and scalar multiplication of algebraic vectors.
6. Express two and three-dimensional vectors in algebraic form.
7. Solve problems related to algebraic vectors, given initial points and terminal points.
8. Define collinearity of algebraic vectors in terms of scalar multiples.
9. Solve related problems involving collinear algebraic vectors.
10. Define coplanar vectors in terms of linear combinations.
11. Solve problems related to coplanar vectors.
12. Find the length of two and three-dimensional vectors.

C. Dot Product

1. Define dot product for algebraic vectors.

2. Simplify and/or evaluate expressions using the dot product of algebraic vectors.
3. Verify that the dot product for geometric vectors is equivalent to the dot product of their algebraic equivalent.
4. Solve problems involving the angle between vectors.
5. Solve problems involving perpendicular (orthogonal) vectors.
6. Define the projection of one vector onto another.
7. Solve problems related to the projection of one vector onto another.
8. Resolve a vector into two perpendicular components, one of which is parallel to a given vector.
9. Define work in terms of dot product and solve related problems.

II. Elective Component

The following topics are suggested as possible elective topics in Mathematics 31. Teachers may choose one or more of these topics or incorporate their own ideas. **The elective is a mandatory component (approximately 20%) of the Mathematics 31 course.**

Topics: Volumes of Revolution
Calculus of Logarithmic Functions
Trigonometric Extensions
Calculus of Trigonometric Functions
*Systems of Linear Equations
Matrices and Linear Transformations
Polar Coordinates

Outlines and suggested learning resources for each of the elective topics listed are provided in the 1984 curriculum guide for Mathematics 31.

*This elective topic should be chosen only after Trigonometric Extensions has been completed.

MATHEMATICS 13-23-33

Learning Resources

Mathematics 13

Prescribed:

Mathematics for a Modern World. Book 2. E. G. Carli, J. C. Egsgard, C. Psica, J. J. Del Grande. Toronto: Gage Educational Publishing Limited, 1975.

Applied Mathematics for Today: Introduction. D. Dottori, R. McVean, G. Knill, J. Seymour. Toronto: McGraw-Hill Ryerson Limited, 1980.

Mathematics 23

Prescribed:

Applied Mathematics for Today: Intermediate. Book 1, Second Edition. D. Dottori, G. Knill, J. Seymour. McGraw-Hill Ryerson Limited, 1976.

Recommended:

Mathematics for a Modern World. Book 3, Second Edition. A. G. Burns, R. G. Pinkney, J. J. Del Grande. Gage Publishing Limited, 1976.

Mathematics 33

Prescribed:

Applied Mathematics for Today: Senior. Book 1, Second Edition. D. Dottori, G. Knill, J. Seymour. Mc-Graw-Hill Ryerson Limited, 1977.

Recommended:

Mathematics for a Modern World. Book 4. E. G. Carli, J. C. Egsgard, C. Psica, J. J. Del Grande. Gage Publishing Limited, 1975.

CORE OBJECTIVES FOR MATHEMATICS 13

I. Core Component*

A. Number Systems

1. Identify numbers as natural, whole, integral and rational.
2. Add, subtract, multiply and divide rational numbers.
3. Convert a rational number from decimal form to fractional form $\frac{a}{b}$ and vice versa.
4. Apply percentage to consumer-related problems:
   a. simple interest
   b. discounts and mark-ups
   c. commissions

B. Equations and Graphing

1. Maintain skills in solving first degree equations with rational coefficients.
2. Solve word problems whose solutions are based on first degree equations with rational coefficients.
3. Identify and use the terms: quadrant, origin, axis, coordinate, ordered pair, abscissa and ordinate.
4. Recognize and graph ordered pairs.
5. Interpret graphs of straight lines.
6. Graph linear equations using:
   a. ordered pairs
   b. intercepts

C. Presentation of Data and Descriptive Statistics

1. Organize data by:
   a. collecting various types of data
   b. grouping data into classes
   c. determining the frequency of each class
   d. defining class width (interval), class boundaries, and class marks
2. Graph data using bar graphs, circle graphs, histograms and frequency polygons.
3. Calculate the mean, median and mode for ungrouped (raw) data.
4. Select the most suitable of the three types of averages for a given set of ungrouped (raw) data.
5. Select a suitable sample from a given population.

D. Variation

1. Identify direct variation.
2. Identify inverse variation.
3. Identify partial variation.
4. Solve problems based on direct, inverse and partial variation.
5. Find the constant of proportionality for a given variation.

E. Exponents

1. Utilize the following laws of exponents:

   Where a, b, ε I; x, y ε R; $x \neq 0$, $y \neq 0$

   $x^a \cdot x^b = x^{a+b}$

   $x^a \div x^b = x^{a-b}$

   $(x^a)^b = x^{ab}$

   $(xy)^a = x^a y^a$

   $\left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$

   $x^o = 1$

   $x^{-a} = \frac{1}{x^a}$

2. Change a number from decimal form to scientific (standard) notation and vice versa.
3. Perform the operations of multiplication and division on numerals expressed in scientific (standard) notation.

F. Polynomials

1. Identify and use the following terms:
   a. algebraic expression
   b. term
   c. factor
   d. monomial
   e. binomial
   f. trinomial
   g. polynomial
   h. coefficient
   i. degree
2. Evaluate a polynomial for given values of the variables.
3. Add and subtract polynomials.
4. Multiply:
   a. monomial x monomial
   b. monomial x binomial
   c. monomial x trinomial
   d. binomial x binomial
5. Write the expansions of

   $(P + Q)^2$, $(P - Q)^2$ and

   $(P - Q) \cdot (P + Q)$

   and recognize them as general cases.

6. Recognize and factor a polynomial with a common factor where the common factor is:
    a. a monomial
    b. a binomial
7. Factor a trinomial of the form

    $ax^2 + bx + c$

    where $a, b, c, \varepsilon I, \quad a \neq 0$
8. Factor polynomials of the form

    $P^2 - Q^2$
9. Factor polynomials by using any combination of methods outlined in objectives 6 through 8.
10. Divide a polynomial by:
    a. a monomial
    b. a binomial

G. Trigonometry

1. Find the unknown sides in similar triangles.
2. Apply similar triangles to practical problems.
3. Define sine, cosine and tangent ratios for right angle triangles.
4. Find the trigonometric ratios of the acute angles in a right triangle when the sides are given.
5. Determine the trigonometric ratios of any given acute angle.
6. Determine the measure of any acute angle given one of its trigonometric ratios.
7. Solve problems based on right triangles using trigonometric ratios.

H. Geometry

1. Recognize and use the following terms: vertex, side (ray), degree, straight angle, right angle, acute angle, obtuse angle, reflex angle, adjacent angles, complementary angles.
2. Recognize and use the following terms associated with triangles: equilateral, equiangular, isosceles, scalene and right triangles.
3. Use the Pythagoras theorem to solve right triangles and associated problems.
4. Recognize and use the following terms associated with polygons: quadrilateral, trapezoid, parallelogram, rectangle, rhombus, square, regular polygon, and diagonal.
5. Recognize and use the following terms associated with parallel lines: transversal, corresponding angles, alternate angles and interior angles.
6. Recognize and use the following terms: congruency, similarity, perpendicular, bisector and perpendicular bisector.
7. Measure an angle with a protractor.
8. Construct an angle congruent to a given angle.
9. Construct the bisector of a given angle.
10. Construct a perpendicular to a given line segment:
    a. at a point on a segment
    b. through a point not on the same segment

11. Construct the right bisector of a line segment.
12. Construct a line parallel to a given line.
13. Solve problems related to vertically opposite angles.
14. State and apply the conditions for congruence of triangles — SAS, SSS, ASA.
15. State the conditions for similarity and solve related problems.
16. State the conditions for parallelism and apply to solving related problems.
17. State and apply area formulas for triangles, rectangles, squares, parallelograms and trapezoids.
18. Solve problems involving numerical applications of the relationships and conditions described in objectives 13-17.

***Note:** The Mathematics 13 course does not include an elective component.

CORE OBJECTIVES FOR MATHEMATICS 23

I. Core Component

A. Radicals

1. Review the basic laws of exponents.
2. Identify each part of a radical expression.
3. Simplify radical expressions form
   $\sqrt[b]{x}$, $b = 2, 3$.
4. Perform the four basic operations on radicals of the form
   $\sqrt[b]{x}$, $b = 2, 3$.
5. Rationalize radical denominators that are monomials and binomials.
6. Solve radical equations containing one radical in one variable.

B. Polynomials

1. Maintain previous skills in algebraic operations.
2. Maintain previous skills of factoring.
3. Maintain previous skills of solving linear equations with one unknown.
4. Simplify rational expressions by factoring.
5. Perform the operation of multiplication and division with rational expressions.
6. Perform the operations of addition and subtraction of rational expressions with:
   a. the same denominator
   b. different denominators

C. Coordinate Geometry

1. Maintain previous skills related to the following: quadrants, axes, origin, ordered pairs and intercepts.
2. Determine the distance between two points.
3. Determine the coordinates of the midpoint of a line segment.

4. Determine the slope of the line passing through two given points.
5. State the relationship between slopes of:
   a. parallel lines
   b. perpendicular lines
6. Graph lines whose equations are in the form

   $Ax + By + C = 0$ or $y = mx + b$,

   using the slope and y-intercept.
7. Use the slope test to determine whether three points are collinear.
8. State the intercepts of a line by examining the graph.
9. Determine the intercepts of a line from its equation.
10. Write an equation and draw the graph of:
    a. a vertical line
    b. a horizontal line
11. Write the equation of a line and draw its graph given a slope and a point on the line.
12. Write the equation of a line passing through a given point and:
    a. parallel to a given line
    b. perpendicular to a given line
13. Given two points:
    a. draw the graph of the line passing through them
    b. write the equation of the line passing through them

D. Presentation of Data and Descriptive Statistics

1. Maintain previous skills of organizing ungrouped (raw) data.
2. Calculate the mean, median and mode of grouped data.
3. Draw histograms and cumulative frequency histograms (ogives) for grouped data.
4. Graphically demonstrate how to obtain and interpret quartiles and percentiles.

E. Systems of Equations

1. Solve linear systems of equations both algebraically and graphically.
2. Identify systems as having many solutions, one solution or no solution.
3. Solve problems based on the solution of systems of equations.

F. Geometry

1. Define and illustrate the following terms related to the circle: radius, chord, interior, exterior, arc, semicircle, segment, sector, central angle, secant line and tangent line.
2. Discover by experimentation the following circle relationships:
   a. a line through the centre of a circle and the midpoint of a chord is perpendicular to the chord (converses should also be considered)
   b. the measure of an inscribed angle is half the measure of the central angle subtended by the same arc (or congruent arcs)
   c. inscribed angles subtended by the same arc (or congruent arcs) are congruent
   d. an angle inscribed in a semicircle is a right angle
   e. a tangent line is perpendicular to the radius drawn to the point of contact

    f. tangent segments drawn to a circle from the same exterior points are congruent
    g. angle between the tangent and the chord is equal to one-half the measure of the intercepted arc

3. Solve problems involving numerical applications of the relationships in objective 2.

G. Trigonometry

1. Maintain previously developed skills in solving the right triangles.
2. Identify cosecant, secant and cotangent as reciprocal ratios of sine, cosine and tangent.
3. Determine the relative measures of the sides of:
    a. a 30 - 60 - 90 triangle
    b. a 45 - 45 - 90 triangle
4. Solve right triangles using any of the trigonometric ratios.
5. Solve problems involving right triangles including angles of elevation and depression.

H. Variation

1. Maintain previous skills of direct, inverse and partial variation.
2. Identify joint variation.
3. Solve problems related to joint variation.

II. Elective Component

The following topics are suggested as possible elective topics in Mathematics 23. Teachers may choose one or more of these topics or incorporate their own ideas. **The elective is a mandatory component (approximately 15%) of the Mathematics 23 course.**

Topics:	Transformational Geometry	Inequalities
	Math Art	Area and Volume
	Consumer Mathematics	

Outlines and suggested learning resources for each of the elective topics listed are provided in the 1983 curriculum guide for Mathematics 13-23-33.

CORE OBJECTIVES FOR MATHEMATICS 33

I. Core Component

A. Relations and Functions

1. Define a relation and its domain and range, utilizing graphs and algebraic statements.
2. Define the term function.
3. Use functional notation f(x) for particular values of x.
4. Define and graph a linear function.
5. Show the relationship between the graphs of linear and quadratic functions and the roots of the corresponding equations.

B. Trigonometry

1. Maintain previously developed skills.
2. Solve problems related to right triangles including:
    a. more than one triangle
    b. three dimensions

3. Determine the value of a trigonometric ratio of any angle.
4. Solve oblique triangles by using Law of Sines and/or Law of Cosines.
5. Apply the Law of Sines and Law of Cosines to practical problems.
6. Derive and apply the following to practical problems:
    a. quotient relations:
    $\tan\theta = \frac{\sin\theta}{\cos\theta}, \quad \cot\theta = \frac{\cos\theta}{\sin\theta}$
    b. reciprocal relations:
    $\csc\theta = \frac{1}{\sin\theta}, \quad \sec\theta = \frac{1}{\cos\theta}$
    $\cot\theta = \frac{1}{\tan\theta}$
    c. pythagorean relations:
    $\sin^2\theta + \cos^2\theta = 1$
    $1 + \tan^2\theta = \sec^2\theta$
    $1 + \cot^2\theta = \csc^2\theta$
7. Solve simple trigonometric equations.

C. Presentation of Data and Descriptive Statistics

1. Maintain previously developed skills with ungrouped and grouped data.
2. Develop and apply standard deviation and z-scores.
3. Illustrate and develop the normal distribution.
4. Introduce probability using an experimental approach.

D. Quadratic Functions, Equations and Applications

1. Identify and express quadratic functions in the form
   $y = ax^2 + bx + c$
   where $a, b, c \in R$, $a \neq 0$.
2. Identify and express quadratic equations in the form
   $ax^2 + bx + c = 0$
   where $a, b, c \in R$, $a \neq 0$.
3. Graph a quadratic function using a table of values.
4. Find the vertex, axis of symmetry, domain, range and maximum or minimum value of a quadratic function from its graph.
5. Use the formula for vertex and axis of symmetry if the quadratic function is given in the form
   $y = ax^2 + bx + c$.
6. State the relationship between the graph of a quadratic function and the roots of the corresponding equation.
7. Write quadratic equations in the form
   $ax^2 + bx + c = 0$ and specify
   the value of a, b, and c.
8. Use the method of completing the square of a quadratic function to find the vertex, axis of symmetry, range and maximum or minimum value. Draw the graph using this information.
9. Solve problems involving the maximum or minimum value of a quadratic function.

10. Compute the real roots of a quadratic equation by:
    a. factoring
    b. using the quadratic formula or completing the square
11. Define and evaluate the discriminant of a quadratic equation.
12. State the nature of the roots by examining the discriminant.
13. Solve problems whose solutions are based on quadratic equations.

E. Logarithms

1. Maintain previous skills on exponents.
2. Identify and graph exponential functions.
3. Convert equations from exponential form to logarithmic form and vice versa.
4. Solve logarithmic equations by converting to exponential form.
5. Define the inverse of an exponential function in logarithmic form.
6. Evaluate expressions and solve equations involving logarithmic form and exponential form.
7. State and use the basic laws or properties of logarithms for:
    a. products
    b. quotients
    c. powers
    d. roots
8. Use logarithms to solve practical problems.

II. Elective Component

The following topics are suggested as possible elective topics in Mathematics 33. Teachers may choose one or more of these topics or incorporate their own ideas. **The elective is a mandatory component (approximately 20%) of the Mathematics 33 course.**

Topics:		
	Absolute Values	Linear Programming
	Complex Numbers	Probability
	Consumer Mathematics	Topology
	History of Mathematics	Vectors

Outlines and suggested learning resources for each of the elective topics listed are provided in the 1983 curriculum guide for Mathematics 13-23-33.

MATHEMATICS 15-25

Learning Resources

Mathematics 15

Prescribed:

Mathematics in Life. Bolster, L. C., Woodburn, H. D. Toronto: Gage Publishing Limited, 1978.

Mathematics for Daily Use. Hayden, M. P., Wells, D. W., et al. Toronto: Doubleday Canada Limited, 1980.

Mathematics Plus. Shaw, B. R., Denholme, R. A., Shelton, G. H. Toronto: Houghton Mifflin Canada Ltd., 1979.

Mathematics 25

Prescribed:

Consumer and Career Mathematics. Bolster, L. C., Woodburn, H. D., Gipson, J. H. Toronto: Gage Publishing Limited, 1980.

Math You Need (Book 2). Cutting, R. J., et al. Scarborough, Toronto: Nelson Canada, 1981.

MATHEMATICS 15 - 25 GOALS

1. To develop in students a background in basic mathematics required in daily life situations.
2. To assist students in developing problem solving techniques which are applicable to a variety of life situations.
3. To revitalize the students' interest in mathematics through successful experiences at the students' level of understanding.
4. To develop in students a knowledge of the development of mathematics, its application in our world both past and present and toward the future.

I. CORE COMPONENT — MATHEMATICS 15

A. Number System

Section A should be considered as a review for most students. Consideration should be given to the use of calculators in the development of concepts and skills.

PREVIOUS NUMBER SKILLS

TOPICS	APPLICATIONS
1. Estimation and reasonableness of answers: • in computation as well as problem solving	1. Use of calculators 2. Vacation costs, living costs, education costs and benefits, building costs, repair costs 3. Problem solving skills 4. Games
2. Place value: • multiplication and division • powers of 10	1. Relation to metric system 2. Money notation 3. Writing cheques
3. Basic operations: • whole numbers • decimals • positive and negative numbers • single fractions	1. Living expense — food bills, rent, car payments, etc. 2. Banking services — deposit slips, cheques and balances 3. Insurance policies — homeowner, car, life 4. Income tax, monthly statements
4. Order of operations: • four basic operations • use of parentheses • application of the cummutative, associative and distributive properties • use of zero and one (concentrate on whole numbers for instructional purposes)	1. Shortcuts in calculations 2. Math skill testing questions on cereal boxes, etc.

B. Measurement

1. Metric measure: • selection of appropriate units	1. Identify suitable units to measure real objects — carpet size, purchase of produce and other goods, medicine, shoelaces, etc.

2. Length: • mm, cm, m, km • selection of appropriate units • estimation • measurement • concept of and formulas for perimeter • measuring instruments — ruler, trundle wheel, clippers, micrometer, odometer • conversion — equivalent units within the SI system • application to real world	1. Estimate and measure length of familiar objects and distance between objects
3. Area: • mm^2, cm^2, m^2, km^2, hectare • selection of appropriate units • estimation • measurements — using a grid, calculation, formula • conversion — equivalent units within the SI system • application to real world	1. Estimate and measure area of familiar objects (books, desk, room) 2. Estimate area covered by finger, hand, shoe
4. Volume: • mm^3, cm^3, m^3 • selection of appropriate units • estimation • measurement — using centimetre cubes, calculation, formula • application to regular solids • conversion-equivalent units within SI system • applications to real world	1. Measure small familiar objects 2. Estimate and calculate volume of large objects
5. Capacity: • ML, L • estimation • measurement — standard and irregular containers • conversion — equivalent units within SI system • application to real world	1. Build a cubic decimetre 2. Estimate and measure volume and relate to capacity
6. Mass: • mg, g, kg, t • selection of appropriate units • estimation • conversion — equivalent units within SI system • application within real world • development of relationship between mass, capacity and volume units	1. Measuring — use of balances, scales
7. Pressure: • Kpa (brief introduction only)	1. Barometric readings 2. Tire and oil pressure
8. Temperature: • celsius — C° • identification of referent temperatures	1. 30°C hot summer day 2. 150°C oven temperature

It is suggested that the History of Measurement Elective be incorporated into the Measurement Strand (as an introduction).

C. Ratio and Rate

1. Concept of ratio:
   - as a fraction form for comparison: $\frac{\text{circumference}}{\text{radius}}$
   - notation: $\frac{C}{r}$ or C:r
   - development of equivalent ratios
     - — from the concept of equivalent fractions
     - — from similar triangles

1. Mixture problems
2. Probability — odds
3. Energy consumption
4. Scale drawings
5. Shopping
6. Salaries
7. Sales costs

2. Concept of rate:
   - per unit form e.g., litres per 100 kilometres, distance per hour

3. Percent:
   - concept of percent:
     - — fraction form — denominator 100
     - — other equivalent fraction forms
     - — discounts
     - — percents to decimals
     - — decimals to percents
     - — percents to fractions to percents

1. Circle graphs
2. Scale diagrams
3. Formulae
4. Grading
5. Taxation
6. Other business and commerce examples
7. Media material (newspaper, ads, flyer)
8. Population trends
9. Other real-world forms
10. Forecasting
11. Other subject areas

D. Data Presentation

1. Interpretation and application of data from charts and graphs:
   - include pictograph, circle graph, bar graph

1. Newspapers, other media
2. Sports and other subject areas
3. Weather forecasts

2. Collection and tabulation of data from environmental situations:
   - from experiments
   - from industrial examples

1. School activities
2. Population trends
3. Ethnic groups
4. Others

3. Construction of pictographs, bar graphs, circle graphs, line graphs from data collected

1. Data on school activities
2. Data on social affairs
3. Data on car sales
4. Data on use of drugs, alcohol, etc.
5. Others

E. Algebra

1. Concept of an expression:
   - identify specific algebraic terminology: constants, variables, terms and factors

2. Evaluating expressions: • substitution into simple expressions and formulas	1. Science formulas: e.g., $d = rt$, $E = I \times R$ Business formulas: e.g., $i = prt$ Geometry formulas: e.g., — area — perimeter — volume
3. Words and algebraic expressions: • translate English expressions into algebraic expressions • translate algebraic expressions into English expressions	
4. Solution of simple equations in one variable: $a + x = b$ $ax = b$ $ax + b = c$ $\frac{x}{a} = \frac{b}{c}$ $ax + bx = c$	
5. Simple word problems	1. Practical problems in the fields of science, business and technology

II. ELECTIVE COMPONENT — MATHEMATICS 15

A. Banking Services

TOPICS	SUBTOPICS (areas of application)
1. Bank accounts	• Savings • Chequing • Personal chequing • Chequing — savings • Service charges • Deposits — cheques • Bank statements • Interest — simple and compound
2. Loans	• Single payment • Discount • Installment • Credit card • Debt consolidation • Education loans • Interest — simple and compound • Bankruptcy
3. Other services	• Safety deposit box • Travellers' cheques • Government bonds • Short term certificates and deposits • Senior citizen services
4. Banks	• Bank of Canada — role • Chartered banks — role, service • Provincial type banks • Credit unions

B. Personal Salaries and Operating Costs

1. Personal income (wage earner or self-employed)
    - Hourly wages
    - Salary — annual or monthly income
    - Commissions

    Deductions
    - Income tax (a major unit within Math 25)
    - Pension premiums
    - Medical insurance
    - Unemployment insurance
    - Others
2. Home ownership costs (house, apartment, condominium)
    - Mortgage payments
    - Utility costs — heat, power, water, telephone, television, etc.
    - Improvement costs
    - Insurance
    - Furnishings
3. Rental (home or apartment)
    - Comparative costs
    - Size, location, lease contracts
    - Comparison to ownership
    - Furnishings
    - Insurances
    - Utility costs
    - Others

C. The Automobile

1. Operating an automobile
    - New or used — initial cost
    - Loan plans
    - Insurance
    - Maintenance costs — operating expenses
    - Depreciation
    - Licence
    - Leasing
    - Fuel consumption versus speed
2. Other items
    - Appreciation of cars (antique)
    - Leasing versus owning
    - Public transit versus driving
    - Fines and other costs involved in driving offences
    - Pollution
    - Brakes — types and effectiveness
    - Tires — cost and effectiveness

D. Budgeting

1. Pricing goods
    - Comparison shopping, Canadian versus foreign items
    - Using the newspaper
    - Timing of sales
    - Seasonal buying
    - Bulk buying
2. Consumer tips — laws for consumers
    - See Consumer Affairs
3. Market surveys
    - Radio reports
    - T.V. programs
    - Government reports

4. Installment purchases	• Automobile, furniture, appliances, etc. • Finance charges (simple interest rates) • Monthly payments
5. Charge accounts	• Types — credit cards and accounts • Credit limits • Minimum payment • Statements • Finance charges (cost or credits)
6. Discounts	• Cash • Trade • Chain
7. Sales tax	• Provincial responsibility and purpose
8. Flexible budgeting	• Fixed expenses, flexible expenses • Savings
9. Holidays	• See Travel and Recreation

E. Travel and Recreation

1. Travel bureaus	• Functions • Travel packages • Seasonal differences • Budget plans
2. Travel costs	• Car, bus, air • Special, seasonal rates • Eurail
3. Living expenses	• Meals • Recreation costs, i.e., Disney World • Purchases • Tips • Gifts • Medical Insurance
4. Money exchange and modes of money use	• Travellers' cheques • Use of credit cards • Customs regulations
5. Map reading	• City maps • Provincial and state routes • Brochures re: travel — tourists' offices

F. Calculator Literacy (Mathematics 15-25)

1. Mechanical aspects of various calculators	• Differences in power supply, automatic shut off • Differences in on/off switch location • Differences in keyboard layout • Durability of construction and proper care of the instrument
2. Capabilities	• Basic operations ($+ \quad - \quad \times \quad \div$) • Basic operations with decimal numbers • Constant and memory features

	• Special function keys $\%$, x^2, y^n $\sqrt{\ }$ • Discuss other special function keys often available to science and commerce in special calculators
3. Limitations	• Recognize: digit capacity, overflow, "error", correction • Type of functions: scientific, commerce • Arithmetic limits: e.g., $1 \div 3 \times 3$ ($1/3 \times 3$) is not 1 using a calculator • Limits of simple calculators in handling masses of data • Complex computations, large number of repetitions
4. Calculator errors	• Errors in reading and keying in data and operations • Errors in reading output and display
5. When to use	• Experience a broad range of use in a variety of computational and problem solving situations • Use calculators in appropriate situations. Recognize and classify computational situations: e.g., (a) memorized number fact, (b) mental arithmetic, (c) pencil and paper arithmetic, (d) simple four-fraction calculator, (e) multi-function or programmable calculator, (f) computer

G. History of Measurement

1. The need for measurement	• Primitive man (choosing club of sufficient size and weight, selecting an animal hide of adequate size, etc.) • Organized societies — trade and commerce • Standardized units
2. Ancient systems of measurement	• Egyptian measure • Greek measure • Roman measure
3. History of the English system	• Influence of the Greeks, Romans and Scandinavians • Imperial measure • American measure
4. History of the metric system	• Mathematical and scientific development (18th Century French Scientists)
5. Le Système International d'Unités	• Refinement and extension of the metric system • Increasing world use of SI

H. Computer Literacy

1. History of computing	
2. How computers work	• Structure of computer systems • Functions of five major parts
3. Control of computers	• Communication with computers • How to instruct computers
4. What computers can and cannot do	• Capabilities and limitations • Misconceptions of computers
5. Characteristics of computers	• Speed, accuracy, tirelessness and the need to be programmed
6. Effect of computers on society	• Impact on individual groups: the economy, education, jobs, crime, etc. • Benefits and dangers of computerization
7. Application of computers	• Uses in business, government, science, education, etc. • Computer careers
8. Computers and the future	
9. Microcomputer operation (for those schools with machines available)	• Canned games and simulation programs • Familiarization with the communication process
10. Introductory programming ideas from Monitor, November, 1979	

Note: These topics for computer literacy are fairly comprehensive; any one or more of the topics may be chosen. It is not expected that the total literacy elective be attempted.

I. Pythagorean Theorem and Similar Triangles

1. Pythagorean theorem	• Right triangle • Reading tables (square and square root)
2. Similar triangles	• Finding missing sides • Practical problems (finding heights, distances, etc.)

J. Graphing on a Coordinate Grid

1. Locating points of a grid	• City maps • Battleship
2. Coordinates as ordered pairs	
3. Cariesian coordinate plane	• x-axis, y-axis origin • Locating points on the plane • Reading coordinates from the plane

I. CORE COMPONENT — MATHEMATICS 25

A. Number System Review

TOPICS	APPLICATIONS
1. Whole numbers: • operations • properties	1. Living expenses 2. Sales 3. Games 4. Problem solving skills

2. Integers: • concept of integers	1. Relate to the real world 2. Temperature 3. Sports 4. Elevation 5. Credit accounts 6. Deposits and withdrawals
• order of integers — location on a number line	1. Interpretation in real world, i.e., travel, profit and loss
• operations — four basic operations	1. GNP, living costs, deficit financing, credit accounts, bank deposits and withdrawals, balance of trade 2. Temperature changes 3. Reading elevation differences, temperature differences, etc., from maps
3. Rational numbers: • concept of rational numbers • operations • convert positive or negative rationals in the form of $\frac{a}{b}$ to decimals and vice versa	1. Sales — 1/3 off, etc. 2. Recipes 3. Stockmarket 4. Time
4. Percent: • concept of percent — fraction form — denominator 100 — other equivalent fraction forms — discounts • conversion — percents to decimals — decimals to percents — percents to fractions to percents	1. Circle graphs 2. Scale diagrams 3. Formulas 4. Grading 5. Taxation 6. Other business and commerce examples 7. Media material 8. Population 9. Other real world forms 10. Forecasting 11. Other subject areas

B. Algebra

1. Equations: • definition of an equation • rules of equations • transposing terms • combining like terms • equations containing fractions and decimals	1. Examine practical problems in the fields of science, business and technology using algebraic and graphical solutions 2. Science formulas — temperature, distance rate — parachutist's fall Geometry formulas — area, perimeter 3. Grid plans for cities and new townsites. Telephone rates are based on a rate system

C. Data Presentation

1. Organization of data: • tables • graphs	1. Relate to charts, graphs and tables in magazines, newspapers, books, kilometre distance charts on maps, etc.
2. Use of frequency tables and diagrams: • population • classes • intervals	1. Inaccurate and biased tables — student grades — height and weight — birth rates — salaries

3. Representation and study of data in graphical form: • pictographs • circle graphs • bar graphs • line graphs • misleading graphs • scatter diagrams • predictions	1. Business and Commerce —GNP, budgets, employment figures, imports and exports, insurance rates and mortality tables, salaries 2. Environment — pesticides, traffic, pollution, fuel efficiency, population makeup, temperatures, energy supplies 3. Health and Medicine — growth rates, calories, hazards of smoking, muscle fatigue, pulse rate, blood types 4. People and Culture — census figures, population sizes and trends, voice ranges, instruments 5. Recreation — sports (batting averages, etc.) gambling, types of T.V. programs
4. Finding mean, median, and mode: • interpretation and use	
D. Life Skills	
1. The world of work: • methods of payment • gross pay • take home pay	1. Salaries, commissions, piecework, overtime 2. Deductions (U.I., CPP., union dues, income tax, others)
2. Income Tax: (Note: suggested that teachers use the tax book for the current year. This is available from Revenue Canada Taxation.)	1. History of Canadian income tax 2. Filing of a simple income tax return (i.e., student part time job) 3. Filing more complicated income tax returns (i.e., married with dependents, two jobs, U.I.)
3. Money management: • gross income • total expenditures (rent, food, clothing, transportation, recreation) • net income and savings • filing income tax return based on above	1. Budgeting for yourself while living with your parents 2. Budgeting for yourself while supporting yourself 3. Budgeting for yourself and your imaginary family after you have "graduated" from your chosen career and are employed full-time

II. ELECTIVE COMPONENT — MATHEMATICS 25

A. Consumer Topics

Insurance (Mathematics 25)

TOPICS	SUBTOPICS (areas of application)
1. Life	• Straight life, endowment, term • Group life • Disability forms • Special features — premiums, double indemnity, insurance policies, cash value, borrowing clauses, mortality tables, etc.

2. Health	• Alberta Health Plan • Blue Cross • Dental plans • Travel insurance — life and health
3. Home owners	• Home, other units — fire, theft, water, storms, etc. • Contents — furniture, other contents • Special possessions • Premiums, liability, etc. • Understanding blueprints
4. Auto	• Types — liability, collision, comprehensive, medical • Rate factors — vehicle type, living location, personal aspects of insured • No fault insurance • Provincial insurance plans • Others — boats, snowmobiles, etc.

Note: Teachers are advised to consult the Mathematics 15-25 curriculum guide for listings of suggested learning resources for the elective component.

Taxation (Mathematics 25)

1. Federal taxes	• Income • Capital gains • Sales • Excise, customs and duties
2. Provincial taxes	• Income • Special forms — licence, car, fishing — road tax — death tax
3. Municipal taxes	• Home and property • Recreational property • Terms — assessment, mill rate, etc.
4. Sales taxes	• Provincial forms • Taxable and non-taxable items

Loans and Financing (Mathematics 25)

1. Bank loans	• Types of loans • Interest charges • Mortgages • Other services • Educational
2. Credit card	• General credit cards — bank association • Store or company cards • Annual and monthly rates • Advantages and disadvantages • Revolving charge accounts • Special credit card loans

3. Installment buying	• Types • Percentage rates — interest rates • Monthly payments
4. Finance companies	• Loan types • Interest charges • Methods of payment

Investments (Mathematics 25)

1. Commodities	• Gold • Silver • Other metals • Grain • Livestock • Jewellery • Stamps • Antiques
2. Stocks and bonds	• Stocks • Mutuals • Savings bonds
3. Real estate	• Land • Buildings • Mortgage investment companies
4. Cash deposits	• Savings account • Banks • Trust companies • Pensions • RRSP • RHOSP

Travel and Recreation (Mathematics 15 - 25)

1. Travel bureaus	• Functions • Travel packages • Seasonal differences • Budget plans
2. Compare travel costs	• Car, bus, air • Special seasonal rates • Eurail
3. Living expenses	• Meals • Recreation costs, i.e., Disney World • Purchases • Tips • Gifts • Medical insurance
4. Money exchange and modes of money use	• Travellers' cheques • Use of credit cards • Custom regulations
5. Map reading	• City maps • Provincial and state routes Brochures re: travel-tourists offices

B. Geometry (Mathematics 25)

TOPICS	APPLICATIONS
1. Concepts and terminology: • angles — related terms and concepts: — vertex, side (ray), degree, straight angle, right angle, acute, obtuse, reflex, adjacent, complementary, supplementary, vertically opposite • triangles — related terms and concepts: — equilateral, equiangular, isosceles, scalene, obtuse, right, hypotenuse, Phythagorean Theorem, conditions for similarity, congruence, trigonometry • polygons — related terms: — quadrilateral, trapezoid, parallelogram, rectangle, rhombus, square, regular, diagonal • parallel lines — related terms and concepts: — transversal, corresponding angles, alternate angles, interior angles, conditions for parallelism when a transversal intersects two lines • circle: — centre, radius, diameter, sector, segment, chords, etc.	1. Paper folding 2. Geoboard 3. Advertising in newspaper, etc. 4. In nature 5. Filing papers — environment, arts, wallpaper, clothing 6. Surface areas in classroom, home, shop and home economics 7. Advertising 8. Sports 9. Traffic signs 10. Construction industry 11. Jewellery design
2. Measure an angle with a protractor	1. Make a protractor
3. Construct: • an angle congruent to a given angle • the bisector of a given angle • a perpendicular to a given segment — at a given point on a segment — through a point not on the same segment • right bisector of a line segment • a line parallel to a given line • construct angles 30°, 45°, 60°, 90° • construct geometric figures — square, rectangle, parallelogram, triangle	1. Using slides, turns, reflections 2. Using compass, straightedge and Mira

4. Prisms and pyramids: • prisms — identified by the base, vertex, edge, face; description of prisms in the real world • pyramids: — identified by the base,vertex, edge, face; description of pyramids in the real world	1. Curve stitching 2. Points, lines, planes in classrooms, shops, school, home 3. Three-dimensional modes 4. Three-dimensional objects in classroom, school, shops, homes 5. Supermarket 6. Architecture, buildings 7. Nets of 3-D objects 8. Nature
5. Trigonometry: • find unknown sides in similar triangles • apply similar triangles to practical problems, e.g., height of a building, distance across a river, etc. • define sine, cosine and tangent functions for right angle triangles • find the ratios of two acute angles in a right triangle when the sides are given • use tables to find trig ratios for a given angle • use tables to find an angle when one of the ratios is given • solve problems based on right triangles using trigonometric ratios	1. Measuring distances to man-made satellites and the moon 2. Measuring by triangulation — use of a range finder 3. Measure circumference of the earth using Eratosthene’s method 4. Finding distances and heights of mountains, trees, rivers, buildings — slope 5. Surveying and scaling 6. Navigation problems by air and water 7. Photography — enlargements and reductions 8. Architectural designs 9. Orienteering 10. Use of apparatus — clinometer, theodolite, transit 11. Apply to radar
6. Pythagorean Theorem	Using the Pythagorean Theorem to calculate indirect measures. Verify measures gained in trigonometric calculations. Calculate heights of cones. In addition to squares on the sides of a right triangle to prove Pythagoras, use equilateral triangles, semi-circles, regular pentagons, etc. Make a Pythagorean spiral.

C. Powers and Roots (Mathematics 25)

1. Laws of indices — understanding and estimation of powers and roots	
2. Calculations involving powers: • multiplication • division	
3. Calculation of square roots: • using tables • using calculators	
4. Scientific notation: • changing conventional numbers into scientific notation form • converting scientific notation into conventional form • multiplication • division	Naming distances within the universe Rewriting answers to products and quotients that are very large or very small Relating scientific notation to pictographs

D. Probability (Mathematics 25)

1. Notation of probability and chance
2. Finding probabilities and predicting outcomes
3. Finding probabilities using a tree diagram
4. Rule for simple probability
5. Odds
6. Dependent and independent events

1. Dice, playing cards, spinners
2. Sports
3. Codes
4. Bingo
5. Licence plates
6. Telephone numbers
7. Weather
8. Coin combinations
9. Insurance
10. Seating arrangements
11. Genetics

E. Motion Geometry (Mathematics 25)

A Study of Transformations

1. Overview of transformations:
   - mapping, distance preserving, isometry, congruence
   - study of motions in geometry
   - models — mirrors, mira, paper folding, tracing paper
2. Basic terminology:
   - translations (slides)
   - reflections (flips)
   - rotations (turns)
   - dilations (enlargements and reductions)
   - distortions
   - line symmetry
   - rotational symmetry
3. Translations (slides):
   - illustrate slides — object, image, slide, arrow, etc.
   - identify relation to congruency
   - relation to vectors
   - illustrations in real world
   - properties
   - application in real world

   Tracing on grid systems
   Skids, ski-lifts
   Artwork — tessalations, wallpaper, lettering, signs
   Machinery — pulleys, planes, etc.
   Movie machines, film frames
   Logos
   Games — pool television

4. Reflections (flips):
   - illustrate flips through activities — object, image, reflection line, symmetry
   - relation to congruency through parallel lines
   - illustrations — art and nature, etc.
   - properties
   - composition of motion
   - applications in real world

   Tracing on grid systems
   Mirror images — science concepts
   Letter through Mira
   Artwork
   Illustrations in nature

5. Rotations (turns):
   - illustrate turn images — centre of rotation, angle of rotation, etc.
   - relation to reflection and congruency through intersecting lines
   - illustrations
   - properties
   - applications in real world

   Trace on grid system
   Turns in real world — transportation careers, driving, etc.
   Industry — machinery, lathes, car repair, etc.
   Use in art world — geometric

6. Dilations (size transformation): • develop enlarged and reduced images • scale drawings • applications in real world	1. Mapping 2. Scale drawing 3. Photography 4. Film Industry — projection microfiche 5. Mirrors — circus 6. Art world
7. Distortions: • draw images using a distorted grid	
8. Basic constructions: • perpendicular and parallel lines • construct geometric figures — various polygons • bisections • corresponding segments • circle	
9. Symmetry and congruency: • both topics integrated within basic motion studies • line, plane and rotational symmetry • applications • properties	

ELECTIVES — OTHER

Calculator Literacy (Mathematics 15 - 25)

TOPICS	SUBTOPICS (areas of application)
1. Mechanical aspects of various calculators	• Differences in power supply, automatic shut off • Differences in on/off switch location • Differences in keyboard layout • Durability of construction and proper care of the instrument
2. Capabilities	• Basic operation (+, −, ×, ÷) • Basic operations with decimal numbers • Constant and memory features • Special function keys • Discuss other special function keys often available to science and commerce in special calculators
3. Limitations	• Recognize: digit capacity, overflow, "error", correction • Type of functions: scientific, commerce • Arithmetic limits; e.g., (1/3 x 3) is not 1 using a calculator • Limits of simple calculators in handling masses of data • Complex computations, large number of repetitions
4. Calculator errors	• Errors in reading and keying in data and operations • Errors in reading output and display

5. When to use	• Experience a broad range of use in a variety of computational and problem solving situations • Use calculators in appropriate situations. Recognize and classify computational situations: e.g., (a) memorized number fact, (b) mental arithmetic, (c) pencil and paper arithmetic, (d) simple four-function calculator, (e) multifunction or programmable calculator, (f) computer

Computer Literacy* (Mathematics 15-25)

1. History of computing	
2. How computers work	• Structure of computer systems • Functions of five major parts
3. Control of computers	• Communication with computers • How to instruct computers
4. What computers can and cannot do	• Capabilities and limitations • Misconceptions about computers
5. Characteristics of computers	• Speed, accuracy and need for appropriate commands
6. Effect of computers on society	• Impact on individual groups, the economy, education, jobs, crime, etc. • Benefits and dangers of computerization
7. Application of computers	• Uses in business, government, science, education, etc. • Computer careers
8. Computers and the future	
9. Microcomputer operation (for those schools with machines available)	• Canned games and simulation programs • Familiarization with the communication process
10. Introductory programming	

Note: These topics for computer literacy are fairly comprehensive; any one or more of the topics may be chosen. It is not expected that the total literacy elective be attempted.

If the "Computer Literacy" elective is used for both Mathematics 15 and Mathematics 25, topics should be dealt with in greater depth at the Mathematics 25 level, or different topics within the elective should be chosen for each course.

*Teachers should be aware of computer related courses taken by the student (e.g., Computer Literacy 10, Computer Processing 10, 20) and should modify this elective topic accordingly to emphasize mathematical applications and problem solving.

SCIENCE

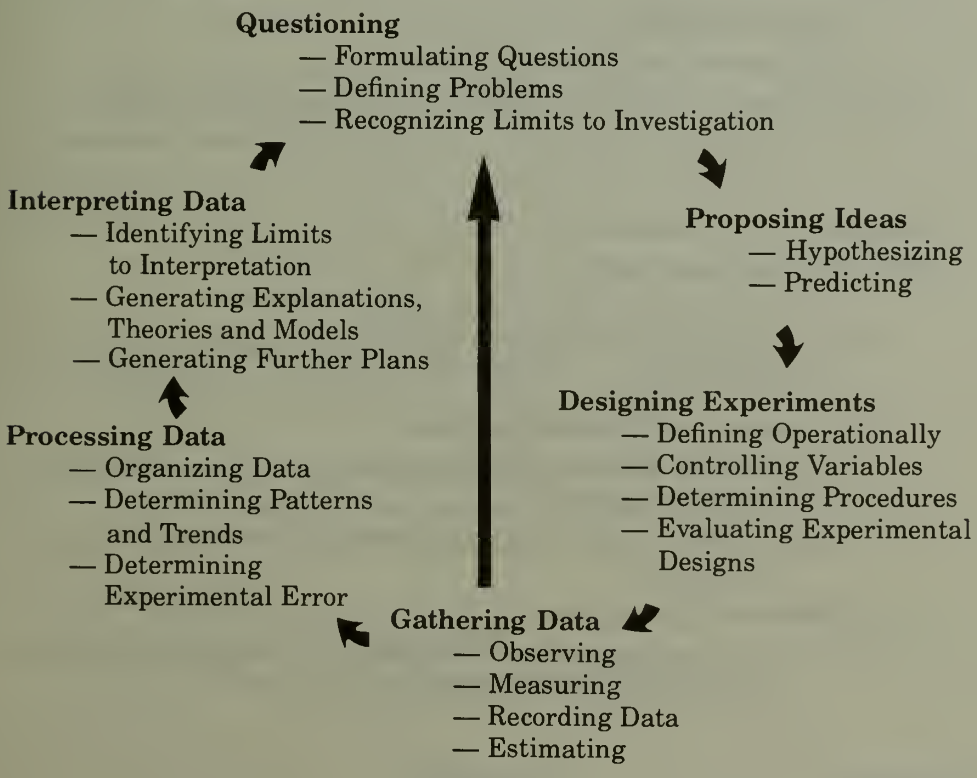
General Objectives of Science Education 1-12

1. To develop the ability to inquire and investigate through the use of science process skills.
2. To promote assimilation of scientific knowledge.
3. To develop attitudes, interests, values, appreciations and adjustments similar to those ideally exhibited by scientists at work.
4. To develop an awareness and understanding of the environment with positive attitudes and behaviors toward its use.
5. To develop a critical understanding of those current social problems which have a significant scientific component in terms of their cause and/or their solution.
6. To promote awareness of the humanistic implications of science.
7. To promote an understanding of the role that science has in the development of societies and the impact of society upon science.
8. To contribute to the development of vocational knowledge and skill.

Inquiry Model and Skills Framework

The following inquiry model serves as the basis for the development of the inquiry process skills in all of the senior high school sciences. Although directional arrows are shown to indicate a typical cycle of inquiry, the sequencing of each stage is not prescriptive. Several of these stages may be of little consequence to a particular investigation and the sequence in which they are treated will vary considerably from one activity to the next. Each of the high school sciences will contribute in its own way, depending on the topic and investigative activities incorporated within instruction. The skill statements illustrated in the following model and framework developed within the context of science are not limited to empirical investigation and scientific inquiry, but are transferable to other areas of study and research.

Inquiry Model



Questioning
- Formulating Questions
- Defining Problems
- Recognizing Limits to Investigation

Proposing Ideas
- Hypothesizing
- Predicting

Designing Experiments
- Defining Operationally
- Controlling Variables
- Determining Procedures
- Evaluating Experimental Designs

Gathering Data
- Observing
- Measuring
- Recording Data
- Estimating

Processing Data
- Organizing Data
- Determining Patterns and Trends
- Determining Experimental Error

Interpreting Data
- Identifying Limits to Interpretation
- Generating Explanations, Theories and Models
- Generating Further Plans

PROCESS SKILLS FRAMEWORK

1. Questioning

- 1.1 Formulating and expressing relevant questions
  - 1.1.1 perceive discrepant events relative to subject matter studied.
  - 1.1.2 perceive possible relationships between objects, events, properties and/or living things.
  - 1.1.3 express questions about perceived relationships.
- 1.2 Defining problem statements
  - 1.2.1 identify specific variables for study.
  - 1.2.2 state possible relationships between these variables.
  - 1.2.3 distinguish information that is relevant to the problem statement from information that is irrelevant.
- 1.3 Recognizing limitations to scientific investigation of given questions and problems
  - 1.3.1 recognize assumptions and limitations implied in the phrasing of questions or problem statements.
  - 1.3.2 recognize the limitations of empirical methods as means of answering identified questions.

2. Proposing Ideas

- 2.1 Formulating hypotheses
  - 2.1.1 describe proposed relationships between variables, referring to known models, theories and other background information where possible.
  - 2.1.2 describe possible relationships between variables in quantitative terms where applicable.
  - 2.1.3 evaluate hypotheses based on existing knowledge and experience.
- 2.2 Stating predictions
  - 2.2.1 predict occurrences and events.
  - 2.2.2 make predictions based on interpolation or extrapolation.
  - 2.2.3 make predictions based on application of a mathematical formula.

3. Designing Experiments

- 3.1 Defining operationally
  - 3.1.1 construct operational definitions.
  - 3.1.2 distinguish between operational and non-operational definitions.
- 3.2 Identifying and controlling variables
  - 3.2.1 identify manipulated (independent) and responding (dependent) variables.
  - 3.2.2 identify variables to be controlled and devise means for controlling them.
- 3.3 Determining procedures
  - 3.3.1 select techniques that are appropriate to the problem and that are safe and ethically sound.

- 3.3.2 select suitable apparatus.
- 3.3.3 identify the purpose of each procedure.
- 3.3.4 determine an appropriate sequence for procedures.
- 3.3.5 state procedures clearly.
- 3.3.6 design a suitable format for recording data.
- 3.3.7 determine the headings to be used within the data recording format.
- 3.3.8 choose appropriate intervals for the manipulated variable.
- 3.3.9 determine the sample size.
- 3.3.10 determine an appropriate number of trials to give a reasonable reliability.
- 3.3.11 determine reasonable levels of precision for all measures.

3.4 Evaluating experimental designs and suggesting modifications where appropriate

- 3.4.1 identify variables that are not controlled by the procedures to be used.
- 3.4.2 identify possible sources of procedural or measurement error.
- 3.4.3 suggest methods for improving precision of measures used.
- 3.4.4 identify missing or extraneous steps in an experimental design.
- 3.4.5 adjust experimental procedures.

4. Gathering Data

4.1 Observing accurately

- 4.1.1 distinguish between observations and inferences.
- 4.1.2 use specialized observation equipment effectively.
- 4.1.3 use specialized sampling and manipulative equipment effectively.

4.2 Measuring accurately

- 4.2.1 identify the precision of measuring instruments used.
- 4.2.2 use measuring instruments with skill and precision.
- 4.2.3 repeat observations and measurements where questionable data arise.

4.3 Recording data clearly and completely

- 4.3.1 record descriptive observations accurately.
- 4.3.2 record measurements in a form that expresses the precision of instruments used.
- 4.3.3 prepare labelled diagrams of objects and materials studied.

4.4 Estimating quantities and measures

- 4.4.1 estimate quantity of objects observed.
- 4.4.2 estimate measures of objects or events observed.
- 4.4.3 distinguish between reasonable and unreasonable values for direct and derived measurements.

5. Processing Data

5.1 Organizing and presenting data

- 5.1.1 classify data into appropriate categories.

- 5.1.2 design charts or tables for processed data.
- 5.1.3 select and apply suitable mathematical treatments of data.
- 5.1.4 indicate units throughout all calculations.
- 5.1.5 produce suitable graphs.
- 5.1.6 choose other means of presenting data where appropriate.

5.2 Determining patterns and trends in data

- 5.2.1 identify patterns and trends.
- 5.2.2 produce "best fit" line for graphs.
- 5.2.3 identify anomalies in data.

5.3 Determining experimental error both for original data and for values derived from these data

- 5.3.1 use significant digits in expressing experimental results.
- 5.3.2 calculate the percent error of experimentally determined values (relative to accepted or predicted values).

6. Interpreting Data

6.1 Identifying limits to interpretations

- 6.1.1 state limitations affecting interpretation of the data.
- 6.1.2 use language that expresses an appropriate level of certainty/uncertainty in stating interpretations.

6.2 Generating appropriate explanations, theories and/or models

- 6.2.1 draw inferences from data.
- 6.2.2 state interpretations within the limits of the experimental design.
- 6.2.3 revise hypotheses in accordance with data collected.
- 6.2.4 generate appropriate explanations, models and/or theories.
- 6.2.5 evaluate alternate explanations, models and/or theories.

6.3 Generating ideas for extending knowledge related to the area of investigation

- 6.3.1 determine need for extension of the investigation.
- 6.3.2 identify additional questions to investigate.

Biology 10-20-30

Note: New course outlines for Biology 10 and 20 were implemented on a mandatory basis effective the 1983-84 school term. Commencing with the 1984-85 school term, revised course objectives for Biology 30 are scheduled for mandatory implementation. New learning resources have been approved for each course.

Learning Resources

Biology 10 and 20

Prescribed:

Biology. Silver Burdett (General Learning Corporation, Canada), 1983.
Biology: Living Systems. Merrill (Bell & Howell Ltd.), 1983.
Laboratory Biology: Investigating Living Systems. Merrill (Bell & Howell Ltd.), 1983.

Recommended:

Modern Biology. Holt, Rinehart and Winston of Canada Ltd., 1984.
Biology: Teacher's Resource Book. Addison-Wesley Publishers Limited, 1984.

Biology 30

Prescribed:

Biology. Addison-Wesley Publishers Limited, 1984.
Biology of Ourselves. John Wiley & Sons Canada Limited, 1982.

Recommended:

Biology: Teacher's Resource Book. Addison-Wesley Publishers Limited, 1984.

Program Organization and Content Emphases

The biology program is based on four major components: process skills, psychomotor skills, attitudes and concepts (subject matter). The percentage emphasis of each component for instruction in Biology 10, 20 and 30 is listed in the table below. Even though each component is listed separately, instruction should integrate process skills, psychomotor skills and attitudes with the development of concepts. Not all these skills nor attitudes have equal emphasis at each course level. Hence, development of these components should take place as the concepts are presented.

Course / Content	Biology 10 (3 credits)	Biology 20 (3 credits)	Biology 30 (5 credits)
Process Skills	30%	30%	20%
Psychomotor Skills	10%	10%	5%
Attitudes	10%	10%	15%
Concepts (Subject Matter)	50%	50%	60%

General Goals for Biology 10-20-30

1. To develop an understanding of the interrelationships of biology, technology and their influence on society.
2. To develop those attitudes, psychomotor and process skills which are associated with scientific inquiry.
3. To develop an interest in biology as a natural science.
4. To develop an awareness of the delicate balance of nature and the appreciation that the survival of all life forms depends upon this balance.
5. To encourage further interest in biological phenomena through the use of electives.
6. To provide a historical perspective to developments in the biological sciences.
7. To prepare students to make responsible decisions regarding science related social issues.
8. To develop an appreciation of how biologists carry out their work.
9. To make students aware of possible careers in the field of the biological sciences.

Objectives for Biology 10 (3 credits)

1. To identify the characteristics that distinguish living things from nonliving things.
2. To develop an understanding of the development of the cell theory and its application.
3. To understand how organisms can be classified into various levels.
4. To initiate an understanding of the differences and similarities that exist among organisms.
5. To develop effective techniques in the use of microscopes.
6. To develop effective dissecting techniques.

Objectives for Biology 20 (3 credits)

1. To develop an understanding of the interactions and interrelationships between biotic and abiotic factors within communities, ecosystems and biomes.
2. To understand the principles of genetics.
3. To recognize some of the reasons why there is a great diversity among organisms.
4. To examine society's impact on the biosphere.

Objectives for Biology 30 (5 credits)

1. To examine selected cell structures and functions.
2. To introduce homeostatic mechanisms and the regulation of body systems.
3. To introduce a chemical basis for life.
4. To examine the following human processes:
    a. Alimentation and nutritional needs
    b. Circulation of body fluids
    c. Breathing and gas exchange
    d. Cellular respiration
    e. Movement and support
    f. Regulation of body fluids
    g. Nervous and hormonal control systems
    h. Reproduction

Process Skills

The inquiry model and process skill statements on pages Science/1-2 form the basis for the development of the scientific process skills component of the biology program. The development of the skill areas (questioning, proposing ideas, designing experiments, gathering data, processing date and interpreting date) is achieved primarily through investigative/laboratory experiences. As such it is critical that students be involved in hands-on activities that emphasize problem-solving skills. The development of the process skills listed for each phase of the inquiry model and framework is further described in the 1984 curriculum guide for Biology 10-20-30.

Psychomotor Skills

Psychomotor skills can be regarded as those skills which involve an integration between muscular movement and intellect. A progressive development of many of these skills throughout the high school biology program is important in areas of the program requiring manipulation of materials and apparatus.

The students should develop skills and ability to:

1. Manipulate equipment
   a. Microscope
   b. Bunsen burner
   c. Microcomputers
   d. Centrifuge
   e. Water baths
   f. Hot plates
   g. Balance
   h. Stethoscopes and sphygmomanometers
2. Use tools
   a. To develop proficiency in the use of various tools and instruments
   b. Use of dissecting instruments
   c. Use of common laboratory tools (beakers, tongs, graduated cylinders, etc.)
   d. Use of mortar and pestle
3. Carry out accepted procedures
   a. Preparation of wet and dry mount slides
   b. Develop techniques for the separation of pigments
   c. Staining techniques
   d. Collecting and preserving techniques
   e. Dissecting procedures
   f. Biochemical analysis techniques
   g. Focusing microscopes
4. Develop safe practices and procedures
   a. Safe use of chemicals in the laboratory
   b. Antiseptic techniques for microbiology
   c. Proper handling of supplies and equipment
   d. Proper handling of living specimens

Attitudinal Objectives

General

1. To promote an appreciation of the interdependencies and interrelationships among biology, technology and society.
2. To develop an interest in biology as a natural science.
3. To develop an interest and appreciation of the attitudes demonstrated by scientists in their work.

4. To develop a sense of responsibility in decision-making concerning science related social issues.
5. To develop an appreciation of science as an important vocational and intellectual pursuit.
6. To develop an appreciation of the historical development of modern science.

Biology 10

1. To develop an appreciation of the diversity among living things.

Biology 20

1. To develop an appreciation of the role man plays in his environment and of his dependence upon that environment.
2. To develop an appreciation of the interdependence of living organisms within their environment.
3. To develop positive attitudes and behaviors toward the use of the environment.

Biology 30

1. To develop an appreciation of the interdependence of human organ systems and their functioning in a homeostatic relationship.

Biology 10

Concepts	Descriptive Statements
I. Living things are composed of cells.	A. The work by Leeuwenhoek and Hooke resulted in the discovery of microscopic life which led to the development of the cell theory.
	B. Some cell structures can be viewed through a regular light microscope. 1. Eukaryotic cells are surrounded by a membrane enclosing cytoplasm and a nucleus. 2. Plant type cells usually include a cell wall, chloroplasts and often enlarged vacuoles. 3. Plant and animal cells display unique and distinguishing characteristics.
	C. Multicellular organisms illustrate such levels of organization as tissues, organs and systems.
II. Taxonomy is the science of classifying organisms.	A. Organisms are grouped on the basis of morphology.
	B. Organisms may also be grouped on the basis of other criteria such as degree of complexity, habitat or nutritional requirements.
	C. Linnaeus developed a system of binomial nomenclature.
	D. Difficulties have arisen in the development of a universally acceptable classification system.
	E. Dichotomous keys are a useful tool in classifying organisms.
III. Viruses are subcellular structures.	A. Viruses have characteristics of both the living and the non-living.
	B. Viruses reproduce within a host cell.
	C. Some diseases are associated with viruses.
IV. Life forms may exist at the unicellular and the multicellular levels of organization.	A. Bacteria are considered the most primitive of known life forms. 1. Bacteria are typical of prokaryotic cells. 2. Bacteria have specific growth requirements. 3. Bacteria are of importance to other organisms. 4. Some diseases are associated with bacteria.
	B. Many eukaryotic cells are unicellular or colonial. 1. Paramecium is a representative protozoan.

Concepts	Descriptive Statements
IV. Life forms may exist at the unicellular and the multicellular levels of organization. (cont'd)	2. Spirogyra exhibit the characteristics of colonial algae. C. Fungi have many unique characteristics. 1. Bread mold exhibits structural and functional characteristics of fungi. 2. Fungi are both harmful and beneficial. D. Most plants are photosynthetic, multicellular organisms. 1. Mosses are successful plants lacking conductive tissue. a. They occupy a variety of habitats. b. They are economically important and significant to the functioning of a biotic community. 2. Ferns are nonseed plants which have conductive tissue. 3. Gymnosperms are nonflowering seed plants. a. They display unique characteristics such as needles, naked seeds and cones. b. They are of significant economic importance. 4. Angiosperms are flowering, seed-producing plants. a. Their characteristics exemplify the most advanced plant form. b. Vegetative parts — roots, stems and leaves — have specific functions. c. Monocots differ from dicots in leaf venation, stem and root branching patterns, seed structure, and the number of flowering parts. d. The flower contains the reproductive organs of the plant. e. Seed and fruit production result from pollination and successful fertilization. E. Animals are multicellular organisms which demonstrate a phylogentic progression toward a greater developmental complexity. 1. Porifera and coelenterata have two cell layers. a. They demonstrate cell specialization. b. Hydra is a primitive coelenterate possessing tissue and nematocysts.

Concepts	Descriptive Statements
IV. Life forms may exist at the unicellular and the multicellular levels of organization. (cont'd)	2. Worms have three cell layers and primitive organ systems. a. The tapeworm demonstrates adaptations to a parasitic lifestyle. b. Lumbricus (the earthworm) provides representation for an in-depth study of organ systems. 3. Mollusks and echinoderms are both harmful and beneficial to other organisms. 4. Arthropods are the largest group of animals. a. They share common characteristics. b. The crayfish provides representation for an in-depth study of more complex organ systems. c. The success of spiders and insects can be measured by their diversity and adaptations. 5. Chordates represent the most complex animal group. a. Chordates possess a notochord, gill pouches and a dorsal nerve cord. b. Fish are a major group of primitive chordates. c. Amphibians have characteristics of both aquatic and terrestrial chordates. The frog provides representation for an in-depth study of chordate organ systems. d. Reptiles display characteristics of the first true terrestrial chordates. e. Birds display characteristics that adapt them for flight. f. Mammals display characteristics of the highest level of complexity.

Biology 20

Concepts	Descriptive Statements
I. Ecology is the study of the interrelationships between organisms and their environment.	A. Many factors are involved in ecological interrelationships.
	1. Biotic factors involve the living world.
	2. Abiotic factors involve the non-living world.
	3. Biotic factors and abiotic factors interact.
	a. Photosynthesis provides both energy and organic materials to the biotic world.
	(i) Chlorophyll and accessory pigments absorb light energy.
	(ii) Light energy is converted into chemical energy.
	(iii) Chemical energy may be utilized in the synthesis of organic compounds.
	b. The flow of matter through the ecosystem is cyclical and may be affected by man's activities.
	(i) Carbon-oxygen cycle and the greenhouse effect.
	(ii) Nitrogen cycle and the importance of soil bacteria.
	(iii) Water cycle and acid rain.
	c. Energy transfer through the biotic world is non-cyclical.
	d. Food chains, pyramids and webs map the flow of energy through the biotic world.
	e. The introduction of herbicides and pesticides into an ecosystem have serious effects on food webs.
	B. Populations are composed of many individuals of the same species.
	1. Populations are defined in terms of space, time and kind.
	2. Populations are characterized by exponential growth patterns.
	3. Limiting factors control population density.
	4. Humans exemplify an overpopulation problem within a closed community.
	C. The biosphere is composed of communities, ecosystems and biomes.
	1. The ecosystem is the fundamental unit of the biosphere.

Concepts	Descriptive Statements
I. Ecology is the study of the interrelationships between organisms and their environment. (cont'd)	a. Succession occurs when biotic communities change over time toward a climax community. b. Organisms occupy a specific niche within a community. c. Many habitats exist within a community. 2. Nutritional relationships exist within a community. a. Symbiosis involves interaction between organisms. (i) Commensalism. (ii) Mutualism. (iii) Parasitism. b. Predator-prey relationships exist in the biosphere. c. Competition occurs within and between species. d. Saprophytes and decomposers aid in the decomposition of organic material. 3. The biosphere contains fresh water ecosystems. a. Changes in running and standing water ecosystems are dependent on physical factors. b. Humans are the major contributor to the pollution of fresh water. 4. Terrestrial ecosystems are studied in terms of biomes. a. Canadian biomes are influenced by climate. b. Major biomes exist in Alberta.
II. Genetics is the study of the transmission of characteristics from one generation to the next.	A. Chromosomes carry the hereditary material. 1. Mitosis is a process of nuclear replication during asexual production. 2. Meiosis is a process of gamete formation necessary for sexual reproduction. a. Diploid chromosome number is reduced to haploid chromosome number. b. Cytoplasmic division differs between egg and sperm formation. c. Abnormal meiotic division may occur. B. Basic principles of heredity were established by Gregor Mendel.

Biology 20

Concepts	Descriptive Statements
II. Genetics is the study of the transmission of characteristics from one generation to the next. (cont'd)	C. Principles of heredity are based upon predictable results. 1. Monohybrid and dihybrid crosses. 2. Codominance and incomplete dominance. 3. Multiple alleles. 4. Sex linkage. D. DNA is the carrier of the genetic code. 1. Each DNA molecule is unique because of its sequence of nitrogen base pairs. 2. DNA is capable of replication. 3. Each protein is unique due to the sequence of amino acids it contains. 4. Specific proteins are synthesized according to sequence of nitrogen base pairs in the DNA molecule. 5. Cells and organisms exhibit traits due to their specific proteins. 6. Mutations arise from variations in the DNA or RNA molecules. E. Hereditary changes affect the characteristics of organisms in a population. 1. Early biologists such as Lamarck and Darwin attempted to explain changes in characteristics in populations. 2. Environmental factors influence gene expression. 3. Several factors influence speciation.

Biology 30

Concepts	Descriptive Statements
I. Cellular processes are fundamental to life.	A. Animal cells exhibit complex structure and function. 1. Membranes. 2. Cytoplasm and nucleoplasm. 3. Organelles. B. Substances necessary for life are transported by physical and chemical processes. 1. Diffusion and osmosis. 2. Active transport. 3. Endocytosis and exocytosis.

Concepts	Descriptive Statements
II. Homeostatic mechanisms regulate the body and its systems.	A. Negative feedback. B. Enzyme action regulates cell metabolism. C. Competitive inhibitors interfere with enzyme activity. D. Acids, bases and buffers.
III. Humans must take in and process the required nutrients for absorption.	A. Basic organic and inorganic substances provide requirements for cell maintenance and growth. 1. Identify the importance of carbohydrates, proteins, lipids, nucleic acids, vitamins, minerals and water. 2. Identify the general structural and functional differences between carbohydrates, lipids and proteins. 3. Carbohydrates, lipids and proteins can be identified in the lab. a. Carbohydrates (Benedict's solution and iodine). b. Lipids (Sudan IV and translucence). c. Proteins (Biuret solution). 4. The anatomy of the digestive system consists of the mouth, esophagus, stomach, small intestine, large intestine and anus. 5. Accessory structures which assist in the process of digestion are salivary glands, liver, gallbladder and the pancreas. 6. Digestion includes the physical and chemical breakdown of ingested macromolecules preparing them for absorption. a. Oral (salivary amylase). b. Gastric (pepsin, HC1). c. Intestinal (carbohydrates, bile, lipase, bicarbonate ion). 7. The release of digestive enzymes is under: a. Mechanical control (peristalsis). b. Hormonal control (gastrin, secretin). c. Nervous control. 8. Nutrients are absorbed into the circulatory system. 9. The large intestine absorbs water and vitamins; stores, then ejects undigested materials. 10. Malfunctions of the digestive system can result in ulcers or gallstones.

Concepts	Descriptive Statements
III. (cont'd)	11. Foreign substances may be absorbed and retained by body tissue.
IV. Body fluids distribute essential nutrients to and carry wastes away from tissues.	A. The heart and its major blood vessels are structured to facilitate circulation. B. Blood circulation occurs in a closed system consisting of arteries, arterioles, capillaries, venules and veins. C. Homeostatic controls maintain cardiac output and blood pressure. 1. Capillary fluid exchange. 2. The medulla oblongata processes information from: a. Stretch receptors. b. Carbon dioxide. 3. Heart tissue is self-stimulating. D. Blood is the primary circulating body tissue fluid. 1. Cellular components have specific functions. a. Erythrocytes transport gases. b. Leucocytes control foreign invading bodies through antibody production and phagocytosis. c. Platelets initiate blood clotting. 2. Non-cellular components include plasma proteins, inorganic molecules, nutrients and waste molecules. 3. Specific proteins determine blood types. a. A, B, O factors. b. Rh factor. 4. Oxygen concentration regulates red blood cell production. E. Malfunctions in the circulatory system may result in heart attacks and strokes. F. Lymph is a secondary circulating body fluid. 1. Lymph system. 2. Lymph function.
V. Breathing precedes gas exchange and transport.	A. The anatomy of the respiratory system includes the: 1. Trachea. 2. Bronchi. 3. Bronchioles. 4. Alveoli.

Concepts	Descriptive Statements
V. Breathing precedes gas exchange and transport. (cont'd)	B. Mechanics of breathing include inhalation and exhalation. C. Gas exchange occurs between the environment, blood and body tissues. D. Hemoglobin and blood plasma are necessary for gas transport. 1. Oxygen is transported as part of the oxyhemoglobin molecule. 2. Carbon dioxide is transported as part of the bicarbonate ion, as part of carbaminohemoglobin and as a molecule dissolved in plasma. E. Breathing rate is controlled by respiratory centers in the medulla. F. Smoking can adversely affect the respiratory system and may result in: 1. Lung cancer. 2. Emphysema.
VI. Energy is released by the oxidation of organic compounds.	A. Cellular respiration involves three basic concepts. 1. Hydrogen and its electron move from weak to progressively stronger electron acceptors. 2. The transfer of hydrogen and its electron releases energy which can be used to form high energy bonds. 3. Some energy is stored as ATP. B. Anaerobic respiration in muscle cells: 1. Takes place in the absence of oxygen. 2. Results in the accumulation of lactic acid. 3. Produces low amounts of ATP. C. Aerobic respiration: 1. Utilizes oxygen as a final electron acceptor. 2. Results in carbon dioxide and water as end products. 3. Produces high amounts of ATP. D. ATP released during cellular respiration is utilized for several metabolic processes including: 1. Synthesis. 2. Movement and muscle contraction. 3. Heat production. 4. Active transport.

Concepts	Descriptive Statements
VII. The kidney provides homeostatic control over body fluids.	A. The excretory system removes metabolic wastes from the blood. 1. Urea, formed in the liver, is a major nitrogenous waste product in the blood. 2. The excretory system involves the kidney, ureter, urinary bladder and urethra. 3. Urine formation involves the glomerulus, Bowman's capsule, proximal and distal convoluted tubules, loop of Henle, and collecting duct. B. Body fluid balance is maintained by hormones and ions. 1. Body fluid is regulated by aldosterone. 2. Osmotic pressure of body fluids is regulated by antidiuretic hormone. C. Dialysis may replace kidney function.
VIII. Regulation of internal environment requires coordination between the nervous and hormonal systems.	A. Endocrine secretions regulate and maintain body functions. 1. Major endocrine glands include the pituitary, pancreas, adrenal and thyroid. 2. Blood sugar regulation is influenced by insulin, adrenalin, thyroxin and glucagon. 3. Hormone levels are regulated by negative feedback. 4. Dwarfism is caused by a deficiency in human growth hormone. B. Nervous control involves reception, transmission, interpretation and response. 1. Stimuli in the environment must first be detected by sensory receptors. a. Eye: (i) The cornea, iris, pupil, lens and retina are involved in image formation. (ii) Light activates rods and cones. (iii) The optic nerve transmits images from the retina to the brain. (iv) Far and near-sightedness and astigmatism are common disorders of the eye. b. Ear: (i) The eardrum, ossicles, round and oval windows, cochlea fluid, and the organ of Corti are involved in sound transmission.

Concepts	Descriptive Statements
VIII. Regulation of internal environment requires coordination between the nervous and hormonal systems. (cont'd)	(ii) The auditory nerve transmits impulses from the cochlea to the brain. (iii) The eustachian tube maintains equal pressure on both sides of the eardrum. (iv) The semicircular canals detect body position and motion. c. Chemoreceptors detect taste and odor. d. Receptors in the skin detect pressure and temperature. 2. Neural transmission relays information throughout an organism. a. Structure of a neuron. b. Electrical activity of a nerve impulse. (i) Threshold levels. (ii) "All or none" response. (iii) Refractory period. c. Chemical transmission between neurons involves excitatory and inhibitory substances. (i) Acetylcholine. (ii) Noradrenaline. (iii) Acetylcholinesterase. 3. The central nervous system interprets information and coordinates response. a. The cerebrum, hypothalamus, cerebellum and medulla oblongata are major regions of the brain. b. The spinal cord transmits information to and from the brain. c. The reflex arc involves peripheral nerves and the spinal cord. 4. The autonomic nervous system involves both sympathetic and parasympathetic nerves.
IX. Voluntary movement and body support are the result of skeletal muscles and the skeletons to which they are attached.	A. The skeleton provides for muscle attachment, protection of internal organs and locomotion. 1. Ligaments. 2. Tendons. 3. Joints. B. Skeletal muscles have a unique structure. 1. Fibers and fibrils.

Concepts	Descriptive Statements
IX. Voluntary movement and body support are the result of skeletal muscles and the skeletons to which they are attached. (cont'd)	2. Actin and myosin. C. Muscle contraction is stimulated by nerve action. D. Muscle contraction requires calcium, creatine phosphate and ATP. E. Inflammation of the joints may result in arthritis.
X. Humans are capable of reproducing.	A. Reproduction systems. 1. The male reproductive system involves the penis, scrotum, testicles, vas deferens, urethra, prostate gland, Cowper's gland and the seminal vessicle. 2. The female reproductive system involves the vagina, uterus, cervix, Fallopian tubes and ovaries. B. The development and functioning of the reproductive system is under the control of hormones. 1. Gonadotrophic hormones regulate the production of sex hormones. a. Follicle-stimulating hormone. b. Luteinizing hormone. c. Interstician cell stimulating hormone (male precursor). 2. Testosterone functions in developing primary and secondary sex characteristics. 3. Estrogen and progesterone function in: a. Developing primary and secondary sex characteristics. b. Menstrual cycle. C. Pregnancy and childbirth. 1. Fertilization and implantation. 2. Pregnancy is maintained through a hormonal balance. 3. Embryonic and fetal development involves a placenta, the amnion, chorion and the umbilical cord. 4. Oxytocin and relaxin are involved in the birth process.

Electives

The elective component comprises approximately 20% of the instructional program. While the elective is mandatory, teachers are permitted some flexibility in the choice of topics that may be included. Teachers should consult the *1984 Biology Curriculum Guide* for suggested elective topics and guidelines concerning their use.

CHEMISTRY 10-20-30

The Chemistry 10-20-30 program is designed to contribute to the achievement of the overall objectives for science education in Alberta, described on page Science/1.

The chemistry program also includes the development of process skill outcomes stated on page Science/2 of this program of studies.

CHEMISTRY 10

Objectives of the Chemistry 10 Program

After participating in the activities and completing the requirements of this course, the student should:

10.1 Know those concepts of chemistry as specified in the core outline.

10.2 Have competence in the language of chemistry, naming and writing the formulas and chemical equations.

10.3 Be skilled in techniques used by investigators in the field of chemistry.

10.4 Have a background knowledge related to the importance of chemicals and chemical processes in our economy.

10.5 Be aware of the possible harm to the environment which may arise from heavy metals.

10.6 Know the contributions made by various scientific investigators to the topics being studied.

10.7 Be aware of chemistry as a possible vocation and have an appreciation of its association with other sciences.

Organization of Program

Approximately 40 hours of instructional time shall be devoted to the core topics and about 25 hours to elective topics. The content of the elective units is to relate to the core in one of three ways:

a. an extension of a core topic.
b. a practical application of a core topic.
c. a topic not directly studied in the course but in some way related.

Prescribed Resources

Ledbetter, E. W., and J. A. Young. *Keys to Chemistry.* Don Mills: Addison-Wesley Publishers Limited, 1977.

Ledbetter, E. W., and J. A. Young. *Laboratory Keys to Chemistry.* Don Mills: Addison-Wesley Publishers Limited, 1977.

Jenkins, F., et al. *ALCHEM 10.* Edmonton: J. M. LeBel Enterprises, 1979.

Recommended Resources

Courneya, D., and H. McDonald. *The Nature of Matter.* Toronto: D. C. Heath Canada Ltd., 1976.

Whitman, R. L., and E. E. Zinck. *Chemistry Today.* Scarborough: Prentice-Hall Canada Inc., 1976.

IAC Modules:
Atkinson, G., and H. Heikkinen. *Reactions and Reason.*
Huheey, J. *Diversity and Periodicity.*
Don Mills: Fitzhenry and Whiteside Ltd. (Harper & Row), 1973.

Outline of Chemistry 10 Core

Concepts:		Subconcepts:	
10.1	The activities of chemical laboratory experimentation require basic skills and knowledge.	10.1.1	Various techniques are used to make qualitative and quantitative observations.
		10.1.2	Safety is of prime importance in the laboratory.
		10.1.3	Laboratory investigations follow a pattern involving such skills as hypothesizing, observing, interpreting, etc.
		10.1.4	The use of graphs in science enables the scientist to relate the variables of an experiment.
10.2	Measurement units are used to describe the properties of matter.	10.2.1	The development of the International System of Units (SI) provided a logical and consistent system of measuring length, mass, time, quantity and temperature.
		10.2.2	The use of significant figures in measurements and calculations is a means of indicating precision.
10.3	Matter is classified in a variety of ways.	10.3.1	Matter is classified on the basis of physical or chemical properties.
		10.3.2	Changes in matter are classified as being physical and/or chemical.
		10.3.3	Matter may be classified as: 10.3.3.1 Mixtures or pure substances. 10.3.3.2 Homogeneous or heterogeneous. 10.3.3.3 Metals or non-metals. 10.3.3.4 Ionic or molecular.
10.4	The present atomic theory was developed on the basis of the accumulation of physical and chemical evidence.	10.4.1	Many scientists contributed to the development of modern atomic theory.
		10.4.2	Structure of an atom consists of a dense, positively charged nucleus surrounded by electrons.
		10.4.3	The periodic table is a classification of the elements on the basis of their chemical and physical properties and atomic structure.
10.5	Chemical reactions may be classified and are represented by a chemical language.	10.5.1	IUPAC rules provide a consistent system for naming chemical substances and writing formulas for them.
		10.5.2	The "mole" is a quantity of matter (6.02×10^{23} particles).
		10.5.3	Chemical reactions may be represented by balanced chemical equations.
		10.5.4	Chemical reactions may be classified according to type of reaction.
		10.5.5	The writing and interpretation of balanced chemical reactions are based on the law of Conservation of Mass.
		10.5.6	Chemicals and chemical reactions have many effects: environmental, economic, industrial, etc.

Chemistry 10 Elective Topics

Elective topics are to be chosen from the following list.

10.1 Metallurgy

10.2 Chemicals in the Environment

10.3 Chemistry of Soap and Cosmetics

10.4 Chemistry of Photography

10.5 Locally Developed Unit

Note: Outlines for elective topics and a list of recommended resources are provided in the curriculum guide.

CHEMISTRY 20

Objectives of the Chemistry 20 Program

After participating in the activities and completing the requirements of this course, the student should:

20.1 Know the chemical principles underlying the chemistry specified in the core outline.

20.2 Be skilled in using proper laboratory techniques used by chemists and laboratory personnel.

20.3 Comprehend the historical development of the chemistry principles being studied.

20.4 Have the capacity to apply the knowledge and skills of chemistry to other situations involving chemicals at home and in industry.

20.5 Have interests and attitudes toward chemistry that will assist in the choice of vocations.

20.6 Know the chemistry facts and principles related to the open discussion of social issues of current interest.

Organization of Program

Approximately 40 hours of instructional time shall be devoted to the core topics and about 25 hours to elective topics. The content of the elective units is to relate to the core in one of three ways:

a. an extension of a core topic.
b. a practical application of a core topic.
c. a topic not directly studied in the course but in some way related.

Prescribed Resources

Ledbetter, E. W., and J. A. Young. *Keys to Chemistry.* Don Mills: Addison-Wesley Publishers Limited, 1977.

Ledbetter, E. W., and J. A. Young. *Laboratory Keys to Chemistry.* Don Mills: Addison-Wesley Publishers Limited, 1977.

Gortler, L. B., et al. *Keys to Organic Chemistry.* Don Mills: Addison-Wesley Publishers Limited, 1977.

Jenkins, F., et al. *ALCHEM 20.* Edmonton: J. M. LeBel Enterprises, 1979.

Recommended Resources

Courneya, D., and H. McDonald. *The Nature of Matter.* Toronto: D. C. Heath Canada Ltd., 1976.
Whitman, R. L., and E. E. Zinck. *Chemistry Today.* Scarborough: Prentice-Hall Canada Inc., 1976.

IAC Modules:
Atkinson, G., and H. Heikkinen. *Reactions and Reason.*
Huheey, J. *Diversity and Periodicity.*
DeVoe, II. *Communities of Molecules.*
Jarvis, B., and P. Mazzocchi. *Form and Function.*
Don Mills: Fitzhenry and Whiteside Ltd. (Harper & Row), 1973.

Outline of Chemistry 20 Core

Solutions

Concepts:	**Subconcepts:**
20.1 Solutions are mixtures.	20.1.1 Solutions are homogeneous mixtures of solute(s) and a solvent. 20.1.2 Solutions may be composed of combinations of solids, liquids and gases.
20.2 Formation of aqueous solutions is a chemical reaction.	20.2.1 Aqueous solutions play a very important part in chemistry. 20.2.2 The dissolving of a solute in a solvent may result in ions, or molecules in solution, and energy changes. 20.2.3 Solutions may be classified as electrolytes or non-electrolytes.
20.3 The proportion of solute to solvent is represented by concentration.	20.3.1 Concentration of solutions is defined in terms of moles of solute per litre of solution, or moles of solute per cubic metre of solution. 20.3.2 Concentration and changes in concentration in solutions can be determined mathematically. 20.3.3 Solutions may be described as unsaturated, saturated, or supersaturated. 20.3.4 Solubility is the concentration of a solute in a saturated solution in equilibrium condition. 20.3.5 Factors that affect solubility are nature of solute and solvent, temperature and pressure.

Bonding

Concepts:	**Subconcepts:**
20.4 Chemical substances exist as elements bonded together.	20.4.1 Chemical bonds may be covalent or ionic. 20.4.2 Molecules formed by covalent bonds may be polar or non-polar. 20.4.3 Bonding between molecules may be classified as dipole-dipole, or hydrogen bonding.

Organic Chemistry

Concepts:	**Subconcepts:**
20.5 Organic chemistry can be termed "Carbon Chemistry".	20.5.1 The carbon to carbon bonding results in a great variety of compounds. 20.5.2 Carbon compounds are some of the most important substances on earth.

20.6	Hydrocarbon compounds form an important group of chemicals.	20.6.1	Hydrocarbons may be classified structurally as aliphatic or aromatic.
		20.6.2	The chemical and physical properties of hydrocarbons are the result of their structure and composition.
		20.6.3	Hydrocarbon reactions can be classified as combustion, substitution, and addition.
		20.6.4	The hydrocarbons form an important base for industry in Alberta.
20.7	Hydrocarbon derivatives form another important group of chemicals.	20.7.1	Major derivatives of hydrocarbons are alcohols, carboxylic acids, and esters.
		20.7.2	The chemical and physical properties of these derivative compounds are the result of their structure and composition.

Chemistry 20 Elective Topics

Elective topics are to be chosen from the following list.

20.1 Chemistry of the Car

20.2 Environmental Chemistry

20.3 Polymers: Long Chain Molecules

20.4 Biochemistry

20.5 Qualitative Analysis

20.6 Locally Developed Unit

Note: Outlines for elective topics and recommended resources are provided in the curriculum guide.

CHEMISTRY 30

Objectives of the Chemistry 30 Program

After participating in the activities and completing the requirements of this course, the student should:

30.1 Know the facts and principles of chemistry as specified by the core outline.

30.2 Have competence in using the processes and techniques of chemistry in the identification of problems and the testing of proposed answers.

30.3 Be aware of the chemical factors related to issues of current interest.

30.4 Be informed about vocational and career opportunities in chemical and technical fields.

30.5 Know the contributions that various investigators have made in the development of current chemical theories.

30.6 Understand the application of the concepts and principles learned in class to the production and use of such products as ethylene, gasoline, plastics, fertilizers, pesticides and foods.

Organization of Program

Approximately 80% of instructional time shall be devoted to the core topics and about 20% to elective topics. The content of the elective units is to relate to the core in one of three ways:

a. an extension of a core topic.
b. a practical application of a core topic.
c. a topic not directly studied in the course but in some way related.

Prescribed Resources

O'Connor, P. R., et al. *Chemistry: Experiments and Principles.* Toronto: D. C. Heath Canada Ltd., 1977.

Davis, J. E., et al. *Laboratory Manual for Chemistry: Experiments and Principles.* Toronto: D. C. Heath Canada Ltd., 1977.

Jenkins, F., et al. *ALCHEM 30.* Edmonton: J. M. LeBel Enterprises, 1979.

or for Acid Base section:

Richardson, R. A. *Proton Chemistry: The Reactions of Acids and Bases.* Rexdale: John Wiley & Sons Canada Ltd., 1976.

Recommended Resources

Parry, R. W., et al. *Chemistry: Experimental Foundations.* Second Edition. Scarborough: Prentice-Hall Canada Inc., 1975.

Metcalfe, H. C., et al. *Modern Chemistry.* Toronto: Holt, Rinehart and Winston of Canada Ltd., 1974.

Young, J. A., and E. W. Ledbetter. *Keys to Oxidation-Reduction.* Don Mills: Addison-Wesley Publishers Limited, 1974.

National Science Curriculum Materials Project:
Slattery, R. T. *Acids and Bases.*
Langrehr, J. S. *Oxidation and Reduction.*
Doherty, J. P. *Energy in Chemical Reactions.*
Agincourt: Gage Publishing Limited, 1975.

IAC Modules
Gordon G. *The Delicate Balance.*
Martin, D., and J. Sampugna. *Molecules in Living Systems.*
Don Mills: Fitzhenry & Whiteside Ltd. (Harper and Row), 1973.

Outline of Chemistry 30 Core

Chemical Energetics

Concepts:		**Subconcepts:**	
30.1	Each substance has a definite and characteristic heat content or enthalpy.	30.1.1	The enthalpy of a substance is the sum of the kinetic and potential energy of the molecules.
		30.1.2	The heat of formation is the energy required or released as a substance is formed from its elements.
30.2	Changes in matter involve a change in energy.	30.2.1	Changes that require energy are endothermic and those that release energy are exothermic.
		30.2.2	More energy is involved in nuclear changes than in chemical changes, and in general more energy is involved in chemical changes than in phase changes.
		30.2.3	In a phase, chemical, or nuclear change, the change in energy is the energy of the products less the energy of reactants.
		30.2.4	The ΔH of chemical and phase changes is determined calorimetrically.
		30.2.5	By addition of ΔH values for known reactions, ΔH values for new reactions can be predicted.

	30.2.6 The amount of energy released or absorbed in a phase, chemical or nuclear change is related to the number of moles of reactants.

Acids and Bases

Concepts:	Subconcepts:
30.3 Acids and bases can be defined in different ways.	30.3.1 Acids taste sour, change the color of indicators, etc. Bases taste bitter, change the color of indicators, etc. 30.3.2 Acids neutralize bases. 30.3.3 Arrhenius defined acids as those substances that increase the H_30+ (aq) concentration and bases as those that increase the $OH-$ (aq) concentration. 30.3.4 Bronsted and Lowry defined acids as proton donors and bases as proton acceptors.
30.4 The relative acidity of a solution can be measured.	30.4.1 The strengths of acids and bases vary and are measures of the equilibrium condition. 30.4.2 The pH scale is a measure of the H_30+ (aq) concentration. 30.4.3 Indicator color may be used to determine pH.
30.5 Acid-base reactions involve an exchange of protons.	30.5.1 An acid-base reaction can be represented by a net ionic equation. 30.5.2 The relative strength of bases can be used to predict the equilibrium conditions. 30.5.3 Titration is one of the main techniques used in quantitative measurement of acid-base reactions. 30.5.4 The determination of quantitative relationships in acid-base reactions is part of stoichiometry.

Oxidation-Reduction

Concepts:	Subconcepts:
30.6 Redox reactions involve an exchange of electrons.	30.6.1 Oxidation is defined as the loss of electrons. Reduction is defined as the gain of electrons. 30.6.2 Oxidizing agents cause oxidation and reducing agents cause reduction to occur. 30.6.3 A redox reaction can be represented by a net ionic equation.
30.7 In a redox reaction the electron loss and gain must balance.	30.7.1 Oxidation numbers of half-reactions illustrate the loss and gain of electrons. 30.7.2 Oxidation numbers or half-reactions may be used to balance equations. 30.7.3 Titration is one of the main techniques used in quantitative measurement of redox reactions. 30.7.4 The determination of quantitative relationships in redox reactions is part of stoichiometry.

30.8	The electrical potential of a redox reaction can be predicted and measured.	30.8.1	Reduction potentials are relative potentials of reduction half-reactions.
		30.8.2	Oxidation potentials are negative reduction potentials.
		30.8.3	The relative strengths of oxidizing and reducing agents are compared in terms of a table of reduction potentials.
		30.8.4	The net potential of a redox reaction is the sum of the oxidation and reduction potentials.
		30.8.5	The spontaneity of a redox reaction can be predicted from the relative strengths of the oxidizing agents or from the positive sign of the net potentials.
30.9	Redox reactions involve electrical energy.	30.9.1	Electrochemical cells convert chemical energy to electrical energy.
		30.9.2	Electrolytic cells are used to convert electrical energy to chemical energy.
		30.9.3	There are many applications of electrochemical and electrolytic cells.

Chemistry 30 Elective Topics

Elective topics are to be chosen from the following list.

30.1 Rates of Chemical Reactions
30.2 Chemical Equilibrium
30.3 Radiation Chemistry
30.4 Organic Derivatives and Products
30.5 Environmental Problems
30.6 Industrial Chemistry
30.7 Foods and Their Analogues
30.8 Fossil Fuel
30.9 Locally Developed Unit

Note: Outlines for each elective, with the exception of 30.9, are provided in the curriculum guide along with a list of references and resource materials.

PHYSICS 10-20-30, 22-32

The Physics 10-20-30, 22-32 program is designed to contribute to the achievement of the overall objectives for science education in Alberta, described on page Science/1.

The physics program also includes the development of process skill outcomes stated on page Science/2 of this program of studies.

PHYSICS 10

Objectives of the Physics 10 Program

The student should:

10.1 Demonstrate knowledge of the general concepts of physics which provide the basis for understanding natural phenomena.

10.2 Develop an understanding of interactions among physical systems.

10.3 Develop attitudes and skills associated with the processes of physics necessary for scientific inquiry.

10.4 Develop an awareness of the humanistic implications of physics.

10.5 Become aware of the impact that physics has had on the development of society.

10.6 Develop an interest in physics as a science and appreciate its close association with the other sciences.

Organization of Program

Approximately 40 hours of instructional time shall be devoted to the core topics and approximately 25 hours to elective topics. Content of elective units is to relate to the core in one of three ways:

a. an extension of a core topic.
b. a practical application of a core topic.
c. a topic not directly studied in the course but in some way related.

Curriculum Core Topics

10.1 Physics as a Science and Physicists as Scientists

    10.1.1 Definition of Physics
    10.1.2 The Role of the Physicist

10.2 The Physics of the Early Greeks

    10.2.1 Ideas of Aristotle as the Basis of Ancient Science
    10.2.2 Natural and Violent Motion
    10.2.3 Union of Aristotelian Physics and Christian Theology
    10.2.4 16th Century Status of Aristotelian Physics

10.3 The Mathematics of Uniform and Non-Uniform Motion

    10.3.1 Motion in the Natural Environment
    10.3.2 Uniform Motion
    10.3.3 Graphical Description of Uniform Motion
    10.3.4 Non-Uniform Motion — Acceleration
    10.3.5 Graphical Description of Non-Uniform Motion
    10.3.6 Graphical Definition of Average Speed and Instantaneous Speed
    10.3.7 Equations of Uniformly Accelerated Motion

10.4 The Insights and Techniques of the 17th Century Used to Describe Motion

- 10.4.1 Achievements of the 16th Century Scientists
- 10.4.2 Galileo's New Approach to the Science of Motion
- 10.4.3 Motion of Freely Falling Bodies
- 10.4.4 Scientific Reasoning Applied to a Definition of Motion
- 10.4.5 Indirect Test of the Galilean Motion Hypothesis
- 10.4.6 Mathematics of Freely Falling Bodies
- 10.4.7 Galileo's 17th Century Inclined Plane Experiment
- 10.4.8 Critical Assessment of Galileo's Procedure
- 10.4.9 Consequences of Galileo's Experiments
- 10.4.10 More Recent Acceleration of Gravity Experiments

10.5 Vector Analysis of Motion

- 10.5.1 Cause, Pattern and Relativity of Motion
- 10.5.2 New Terms Which Describe Motion
- 10.5.3 Graphical Analysis of Motion Using Vector Symbolism
- 10.5.4 Algebraic Analysis of Directional Motion
- 10.5.5 Vector Analysis of Motion

10.6 Natural Forces and Newton's Explanation of Motion

- 10.6.1 Accounting for the Cause of Motion
- 10.6.2 Forces as Vector Quantities
- 10.6.3 Sign Convention of Force Vectors
- 10.6.4 Vector Analysis of One and Two-Dimensional Forces
- 10.6.5 Newton's First Law of Motion
- 10.6.6 Experimental Verification of the Inertia Principle
- 10.6.7 Mass as a Fundamental Property of Matter
- 10.6.8 Newton's Second Law of Motion
- 10.6.9 System Internationale Unit of Force
- 10.6.10 Newton's Third Law of Motion
- 10.6.11 Differentiating Between Mass and Weight
- 10.6.12 Apparent Losses in Weight of Bodies

Elective Topics

Elective topics must be chosen from the following list.

10.1 Motion in the Heavens I

10.2 Motion in the Heavens II

10.3 Cosmology

10.4 Fluids at Rest

10.5 Science and Scientists

10.6 Space Exploration

10.7 Experimental Studies of Motion

10.8 A Locally Developed Unit

Note: Outlines for each elective, with the exception of 10.8, are provided in the curriculum guide along with a list of references and resource materials.

Prescribed Resources

Paul, D., et al. *Physics: A Human Endeavor, Unit 1, Motion.* Toronto: Holt, Rinehart and Winston of Canada Ltd., 1976.

Objectives of the Physics 20 Program

The student should:

20.1 Demonstrate knowledge of the physical principles underlying the topics of physics specified in the course outline.

20.2 Develop skill in using experimentation, mathematical techniques, and other strategies as a means of substantiating knowledge of physical principles.

20.3 Become aware of the historical development of physics as a discipline.

20.4 Become aware of the social impact, past and present, of the application of physics principles.

20.5 Develop the ability to apply knowledge of physical principles to vocational and avocational interests.

20.6 Attain a deeper insight into environmental problems through understanding physical limitations.

20.7 Develop a positive attitude toward physics and an interest in science.

Organization of Program

Approximately 40 hours of instructional time shall be devoted to the core topics and approximately 25 hours to elective topics. Content of elective units is to relate to the core in one of three ways:

a. an extension of a core topic.
b. a practical application of a core topic.
c. a topic not directly studied in the course but in some way related.

Curriculum Core Topics

20.1 Momentum and the Interaction of Bodies in Nature

- 20.1.1 Conservation of Mass
- 20.1.2 Problem of Discovering a Quantity of Motion
- 20.1.3 The Collision of Bodies
- 20.1.4 Conservation of Momentum
- 20.1.5 Using the Law of Conservation of Momentum

20.2 Energy as a Key Concept in the Study of Science

- 20.2.1 Energy
- 20.2.2 Work
- 20.2.3 Power
- 20.2.4 Kinetic Energy
- 20.2.5 Potential Energy
- 20.2.6 Gravitational Potential Energy
- 20.2.7 Conservation of Mechanical Energy
- 20.2.8 Friction and Molecular Interaction
- 20.2.9 Heat as a Form of Energy
- 20.2.10 Law of Conservation of Energy

20.3 Nature and Propagation of Waves

- 20.3.1 Waves as Energy Carriers
- 20.3.2 Transverse and Longitudinal Waves
- 20.3.3 Physical Description of Waves
- 20.3.4 Reflection and Refraction of Waves
- 20.3.5 Diffraction and Interference of Waves

Elective Topics

Elective topics must be chosen from the following list.

20.1 Kinetic Theory of Matter II

20.2 The Physics of Sound

20.3 Energy: Resources, Crises and Conservation

20.4 Heat, Calorimeters and Expansion

20.5 Physics and the Environment

20.6 Simple Machines

20.7 Physics and Personal Safety

20.8 A Locally Developed Unit

Note: Outlines for each elective, with the exception of 20.8, are provided in the curriculum guide along with a list of references and resource materials.

Prescribed Resources

Paul, D., et al. *Physics: A Human Endeavor, Unit 3, Energy and Conservation Laws*. Toronto: Holt, Rinehart and Winston of Canada Ltd., 1976.

PHYSICS 30

Objectives of the Physics 30 Program

The student should:

30.1 Demonstrate knowledge of the physical principles underlying the topics of physics specified in the course outline.

30.2 Develop a facility in using scientific processes to identify and to solve problems.

30.3 Develop background knowledge related to social issues of current interest.

30.4 Gain information and insights into vocational and career opportunities in the physics, engineering and allied sciences.

30.5 Develop the ability to discuss the importance of objectivity in scientific research.

30.6 Recognize and cite evidence of contributions that various investigators have made in the development of modern physical theories.

Organization of Program

Approximately 80% of instructional time shall be devoted to the core topics and approximately 20% to elective topics. Content of elective units is to relate to the core in one of three ways:

a. an extension of a core topic.
b. a practical application of a core topic.
c. a topic not directly studied in the course but in some way related.

Curriculum Core Topics

30.1 Nature and Behavior of Light

- 30.1.1 Propagation of Light
- 30.1.2 Reflection and Refraction
- 30.1.3 Interference and Diffraction
- 30.1.4 Dispersion
- 30.1.5 Polarization
- 30.1.6 Deficiencies of the Wave Model

30.2 Electric and Magnetic Fields

- 30.2.1 Electric Charges and Forces
- 30.2.2 Forces and Fields
- 30.2.3 Moving Charges
- 30.2.4 Moving Charges and Magnets

30.3 Electro-Magnetic Radiation

- 30.3.1. Electromagnetic Theory
- 30.3.2 Propagation of Electromagnetic Waves
- 30.3.3 Evidence for Electromagnetic Waves
- 30.3.4 The Electromagnetic Spectrum
- 30.3.5 The Ether Concept

30.4 The Structure of Matter

- 30.4.1 Chemical Nature of the Atom
- 30.4.2 Electrical Nature of the Atom
- 30.4.3 Quantum Behavior of Matter
- 30.4.4 Rutherford-Bohr Model of the Atom
- 30.4.5 Inadequacies of Atomic Models

30.5 Modern Physical Theories

- 30.5.1 Some Results of Relativity
- 30.5.2 Particle-like Behavior of Radiation
- 30.5.3 Wave-like Behavior of Particles
- 30.5.4 Significance of Mathematical Atomic Model
- 30.5.5 Heisenberg's Uncertainty Principle
- 30.5.6 Probability Interpretation of Quantum Mechanics

Elective Topics

Elective topics must be chosen from the following list.

30.1 Geometric Optics

30.2 Optical Instruments

30.3 Kinetic Theory of Matter II

30.4 The Special Theory of Relativity

30.5 Alternating Current

30.6 Electrical Circuits

30.7 Vectors and Equilibrium

30.8 Meters, Motors and Generators

30.9 The Speed of Light

30.10 Trajectories and Orbits

30.11 Energy Measurement

30.12 A Locally Developed Unit

Note: Outlines for each elective, with the exception of 30.12, are provided in the curriculum guide along with a list of references and resource materials.

Prescribed Resources

Rutherford, F. J., et al. *Project Physics: Text/Handbook Unit 4, Light and Electromagnetism.* New York: Holt, Rinehart and Winston of Canada Ltd.

Rutherford, F. J., et al. *Project Physics: Text/Handbook Unit 5, Models of the Atom.* New York: Holt, Rinehart and Winston of Canada Ltd., 1975.

PHYSICS 22

Physics 22 is designed for students in vocational high schools who are taking programs which articulate with the institutes of technology, e.g., drafting, electronics, machine shop. It is expected that students in other programs may elect this course. Teachers should feel free to adjust the content and method of presentation to the capabilities of their classes; however, it is felt that students in the articulated programs should substantially cover the program as outlined.

Texts

White. *Physics, An Exact Science.*
White. *Laboratory Exercises to Accompany Physics. An Exact Science.*
or
White. *Physics, An Experimental Science.*
White. *Laboratory Exercises to Accompany Physics, An Experimental Science.*

Course Outline

1. Introduction — Lessons 3, 4*.
2. Properties of Matter — Lessons 4, 5*, 6, 7*.
3. Light — Lessons 1, 2, 3*, 4, 5*, 6, 7, 8*, 9, 10*, 11, 12, 13*, 14, 15*.

PHYSICS 32

As for Physics 22, Physics 32 is designed for students in vocational high schools who are taking programs which articulate with the institutes of technology and is expected to be equivalent to the Year "A" Physics program in the technical institutes. Information on course content and laboratory exercises follows.

Texts

White. *Physics, An Exact Science.*
White. *Laboratory Exercises to Accompany Physics, An Exact Science.*
or
White. *Physics, An Experimental Science.*
White. *Laboratory Exercises to Accompany Physics, An Experimental Science.*

Course Outline

1. Mechanics — Lessons 1, 2*, 3, 4*, 5, 6, 7, 8*, 9, 10, 11*, 12, 13*, 14, 15, 16*, 17, 18*, 19, 21, 23, 24, 27, 29, 30*, 31, 32, 33*.
2. Electricity — Lessons 1, 2, 3, 4*, 5, 6*, 7, 9.
3. Heat — Lessons 1, 3, 7*, 8, 9, 11, 12*.

*The lessons which are marked with an asterisk are laboratory experiments.

SCIENCE 11

The Science 11 program is designed to contribute to the achievement of the overall objectives for science education in Alberta, described on page Science/1.

The Science 11 program also includes the development of the process skill outcomes stated on page Science/2 of this program of studies.

Science 11, as a program, should continue to emphasize skills, concepts, attitudes, humanistic and social implications of science which have been developed for the elementary and junior high school grades.

In this course, content is significant only to the degree that it provides for the realization of other objectives of the course. Student interest should be a significant criterion in the selection of learning experiences.

Major Objectives of Science 11

1. To enhance the student's self-image and develop a positive attitude toward science. The student should:
   a. pursue areas of personal interest.
   b. participate in activities in which he/she can experience success.
2. To develop a critical understanding of some current social problems which have a significant scientific component in terms of their cause and/or their solution. The students might study problems such as:
   a. depletion of natural resources.
   b. pollution of water and air.
   c. over-population.
   d. improper use of chemicals.
   e. science for the consumer.
3. To help students appreciate the scope of science. That is, the student should:
   a. recognize that science is a basic part of modern living.
   b. recognize that science involves both inquiry processes and conceptual patterns.
   c. recognize the interaction of science, the arts and the humanities.
   d. recognize that the achievements of science and technology, properly used, are basic to the advancement of human welfare.

Rationale for the Science 11 Program

Student involvement in Science 11 should lead to successful experiences in learning and studying in various fields of science. During this course, it is hoped that students, as a result of their successful experiences, will develop an attitude which allows them to realize the changes in their lives which science brings about.

It is understood that the students taking Science 11 will have, in relation to science, a wide range of attitudes, interests, abilities, backgrounds, experiences, and knowledge. In order to assist teachers of these students in selecting relevant materials for their students, a wide range of resources for classroom use has been identified. These resources, however, are not meant to be restrictive and teachers should feel free to supplement them.

Prescribed Resources

Heimler, C. H., et al. *Principles of Science*. Book 2, Fourth Edition. Charles E. Merrill Publishing Co., 1979.

Kaskel, A., et al. *Principles of Science. Book 2 "A Learning Strategy for the Laboratory"*. Charles E. Merrill Publishing Co., 1979.

Individual Science Instructional System (I.S.I.S.) 1976-81. Selected titles. Please refer to the Alberta School Book Branch catalogue for listing and prices.

community groups and agencies. Elective topics should help students develop an understanding of current concerns at local, provincial, national and international levels.

IV. LEARNING RESOURCES

1. Prescribed Learning Resources:

Three to ten print and/or nonprint resources have been prescribed for social studies instruction at each grade level.

The prescribed resources are those resources that Alberta Education has assessed as the best presently available for achieving the objectives of grade level social studies programs. These resources are listed in the documents below and are available for purchase at a 40% discount at the Alberta School Book Branch.

— *1984-85 Alberta School Book Branch Catalogue*

— *1984 Social Studies Learning Resources Manual for Elementary Schools*

— *1984 Social Studies Learning Resources Manual for Secondary Schools*

Resources, once prescribed, retain this status for a mimimum of three years.

Resources that are prescribed for use with the Alberta Social Studies Curriculum are as follows:

Grade & Topic	**Title**	**Publisher**
10A	*Human Rights: Respecting Our Differences*	Alberta Human Rights Commission
10B/C	*In Search of Canada*, Vol. II	Prentice-Hall Canada Inc.
11A	Viewpoints in World History Series: *What Were the Causes of the Protestant Reformation?*	Nelson Canada
11A/B	*Our Western Heritage*, Units 1-4	Ginn and Company
11A/B	*The State of the World Atlas*	Pan Books (Collins)
11B	*Challenge for Change: Geographical Approach to Selected World Issues*	McGraw-Hill Ryerson Limited
11B	*Environmental Concerns, The World*	Academic Press Canada
11B	*World Prospects*	Prentice-Hall Canada Inc.
12A	*Ideologies*	McGraw-Hill Ryerson Limited
12A	*Political and Economic Systems* (Revised Edition)	Academic Press Canada
12A/B	*Modern Perspectives*	McGraw-Hill Ryerson Limited

12A/B	*Our Western Heritage,* Units 5-9	Ginn and Company
12A/B	Viewpoints in World History Series: *How Did the Communists Seize Power in Russia?* *The Rise of the Nazi Horror: Who Was Responsible?*	Nelson Canada
12B	*The Contemporary World: Conflict or Cooperation*	Academic Press Canada
12B	*War and War Prevention*	Hayden Book Company Ltd.
12B	*Why Nations Go To War*	MacMillan of Canada

WHAT IS PRESCRIBED IN ALBERTA SOCIAL STUDIES: A SUMMARY

1. Three (3) topics for each of Grades 1 through 10 and two (2) topics for each of Grades 11 and 12 are prescribed for study.
2. One social issue per curriculum topic is prescribed for inquiry. Teachers are encouraged to modify specific issues so long as the general intent and meaning are preserved.
3. Value objectives, knowledge objectives and skill objectives are prescribed for each topic.
4. The model of social inquiry should be viewed as a flexible process that can be expanded or modified by teachers to reflect the needs of individual students and classrooms. Availability of resources and disciplinary emphasis of the topic will also affect the specific approach to inquiry in which teachers and students engage in social studies.
5. Social action is not prescribed but is encouraged where possible and when desirable/feasible.
6. The mandatory core comprises 75 percent of the program and is represented by the 34 topics and the statements of objectives. The optional elective portion comprises up to 25 percent of the program.
7. Prescribed learning resources are those listed in these documents: *1984-85 Alberta School Book Branch Catalogue, 1984 Social Studies Learning Resources Manual for Elementary Schools and 1984 Social Studies Learning Resources Manual for Secondary Schools.*

   NOTE: Prescribed resources have been identified as being the most suitable for facilitating the attainment of a majority of prescribed objectives for a specific topic. They are identified as being the best resources presently available for the *1981 Alberta Social Studies Curriculum.* Recommended learning resources are also listed in the documents named above. These curriculum materials are complementary to prescribed resources. As such, these resources may be used to facilitate the attainment of some of the prescribed objectives. The choice of which particular resources are to be obtained, and how they will be used, is basically a local decision. Teachers may supplement all resources with additional materials identified at the local level. Section 12(2)b of the School Act states that such materials must be approved by the school board.

2. Recommended Learning Resources:

Recommended resources include print and/or nonprint materials which contribute to one or more social studies objectives, as well as curriculum materials which are complementary to prescribed resources (e.g., teachers' guides). These resources are listed in the documents named above and are available for purchase at a 15% discount from the Alberta School Book Branch.

LB 1629-5 A3 A35 1978 GR-10-12
AMEND- 1984
PROGRAM OF STUDIES FOR SENIOR
HIGH SCHOOLS --
39897100 CURR HIST

000022830079

LB 1629.5 A3 A35 1978 gr.10-12
amend. 1984
Program of studies for senior
high schools. -
39897100 CURR HIST

CURRICULUM GUIDE

For Reference

NOT TO BE TAKEN FROM THIS ROOM

EXCEPT WITH LIBRARIAN'S PERMISSION